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SCIENCE

Vol. 104, No. 2700 Friday, 27 September 1946

The World Health Organization

Michael B. Shimkin

Surgeon, U.S. Public Health Service, and *Assistant Chief, Office of International Health Relations, Washington, D.C.*

ON 22 JULY 1946, AN HISTORIC DAY for public health and medicine, representatives of 61 nations signed the constitution of the World Health Organization, the first fully empowered international agency in public health.

The International Health Conference, which established the World Health Organization, was the first conference to be called by the United Nations. It is appropriate that this honor went to the field of public health and medicine and emphasized its role in the development of international peace and friendship. The World Health Organization is the first specialized agency of the United Nations to which every member of the United Nations has subscribed. More than that, nations not members of the United Nations were invited to the deliberations and were asked to join the Organization, and 10 such nations also signed the charter.

The nature and the purposes of the World Health Organization are well implied in its name. Deliberately discarded were more restrictive names, such as the International Health Organization or the Health Organization of the United Nations. For the first time emphasis was laid not upon quarantine and checking epidemics and other defensive measures, but upon positive, aggressive action toward health in its broadest sense. The preamble begins upon this note, declaring that "Health is a state of complete physical, mental, and social well-being and not merely the absence of disease or infirmity." This standard of health is defined as one of the fundamental rights of every human being.

The history of the World Health Organization begins at the United Nations Conference on International Organization, which met in San Francisco on 25 April 1945. At the instigation of Brazil, the word "health" was introduced in applicable sections of Chapters IX and X of the Charter of the United Nations, dealing with international economic and social cooperation. The Conference also recognized the importance of health problems and their solution by approving unanimously a joint declaration proposed by Brazil and China for the purpose of establishing an international health organization.

Plans for bringing into being such an organization were started shortly thereafter in several nations. In the United States, the Surgeon General of the Public Health Service established the Office of International Health Relations, and the Health Branch of the Division of International Labor, Social and Health Affairs of the Department of State was staffed with Public Health Service officers to work on this problem. In October 1945 the plans developed by these groups were examined by an advisory health group of 30 leaders in public health and civic activities, called together by the Department of State under the chairmanship of Dr. Thomas Parran. The interest of the United States in this field was impressively emphasized by the Senate, which in December 1945 passed a joint resolution requesting the President to take immediate steps toward the early convening of a health conference and the formation of an international health organization.

Attempts were made to call the International Health Conference through the sponsorship of several nations, but it was decided that this action should come through the United Nations. As a result, on 15 February 1946, the Economic and Social Council of the United Nations adopted a resolution calling for a Technical Preparatory Committee on Health, to meet in Paris and an International Health Conference, to be convened in New York in June 1946.

The Technical Preparatory Committee on Health met in Paris on 18 March 1946. The Committee was composed of 16 experts[1] named by the Economic and Social Council, accompanied by alternates and advisers. The Committee elected Dr. René Sand, of Belgium, as its chairman. During a three-week session, annotated agenda and proposals for an International Health Conference were prepared. Four basic docu-

[1] Bermann (Argentina), Sand (Belgium), de Paula Souza (Brazil), Chisholm (Canada), King and Sze (China), Cancik (Czechoslovakia), Shousha (Egypt), Cavaillon and Leclainche (France), Mani and Katial (India), Martinez-Baez (Mexico), Evang (Norway), Kacprzak (Poland), Jameson and Mackenzie (United Kingdom), Parran and Doull (United States), and Stampar (Yugoslavia). The Union of Soviet Socialist Republics was invited but did not accept.

ments, submitted by France, the United Kingdom, the United States, and Yugoslavia, were considered as a basis for the development of a constitution for a single new international health organization. The documents submitted by France and Yugoslavia served in the development of the preamble, and the United States document was used as the basis for the remainder of the proposed constitution.

The proposals as agreed upon by the Technical Preparatory Committee were circulated among all members of the United Nations. A conviction was expressed that membership in the proposed World Health Organization should be open to all nations, and a resolution recommending participation as observers of nations not members of the United Nations at the International Health Conference was adopted. Dr. Parran, in his official report, concludes that the meeting was marked by a desire for the speedy development of a World Health Organization of broad scope and high purpose as a specialized agency to be brought into relationship with the United Nations.

The International Health Conference called by the Economic and Social Council of the United Nations met in New York City from 19 June to 22 July 1946. Delegations from all of the 51 United Nations took part in the deliberations; representatives from 13 nonmember nations,[2] 3 allied control authorities,[3] and 10 international organizations[4] attended the meetings as observers. Dr. Parran, Surgeon General of the U. S. Public Health Service and chief delegate of the United States, was elected unanimously as president of the Conference. Vice-presidents were Sir Wilson Jameson, United Kingdom; Dr. Fedor G. Krotkov, Union of Soviet Socialist Republics; Dr. James Kofoi Shen, China; Dr. Geraldo H. de Paula Souza, Brazil; and Dr. André Cavaillon, France.

The preparatory work done before the Conference greatly facilitated the progress of the meeting. There were, in effect, only two major unresolved problems upon which no previous agreement had been reached. One of these was whether the Soviet Union would participate in the discussions and join the organization. This subject was resolved by the arrival of delegates from the Soviet Union, ably led by the Deputy Minister of Health, Dr. Krotkov. The second problem concerned regionalization and the role of existing international organizations dealing in the field of public health. It had been decided in Paris that the Office International d'Hygiene Publique should be absorbed by the World Health Organization, and the same action was agreed upon regarding the fate of the Health Section of the League of Nations and of the epidemiologic intelligence of the health section of the United Nations Relief and Rehabilitation Administration. The Conference decided that the Pan-American Sanitary Bureau should be integrated with the Organization through "common action based on mutual consent."

It is worthy of note that although prolonged debate took place on several issues, particularly on regionalization and the admittance to membership of nations not members of the United Nations, and although close votes were recorded on some points of detail, the decisions reached on all matters were approved unanimously by the Conference. As a result, representatives of all of the United Nations signed the charter at the end of the meeting, China and the United Kingdom without reservation and the remainder of the nations *ad referendum*. Ten nations not members of the United Nations also affixed their signatures to the constitution. Nations which did not attend the Conference will be admitted as members when their application has been approved by a simple majority vote of the Health Assembly.

The World Health Organization will come into being when 26 members of the United Nations ratify the signatures of their delegates. For the period between the Conference and the first meeting of the Organization, the Conference set up an Interim Commission to conduct the essential business of the Organization and to work out details of agreements between the Organization and other international agencies. This Commission consists of 18 nations.[5] Its temporary chairman was Dr. Krotkov; its present chairman, Dr. Andrija Stampar, of Yugoslavia; and its executive secretary, Dr. G. B. Chisholm, of Canada. Officers of the permanent organization will be selected at the first meeting of the World Health Organization, which will probably convene within the forthcoming year.

What can the world expect this organization to achieve? Examination of the constitution will show that the International Health Conference created a document that is idealistic, yet practical, and broad in scope, yet sufficiently specific. It has formed an organizational pattern that will enable the world to go far toward the fulfillment of the purpose, "the attainment by all peoples of the highest level of health."

[2] Albania, Austria, Bulgaria, Eire, Finland, Hungary, Iceland, Italy, Portugal, Siam, Sweden, Switzerland, and Transjordan. Afghanistan, Rumania, and Yemen were also invited to send observers but were not represented.

[3] Germany, Japan, and Korea.

[4] Food and Agriculture Organization, International Labor Organization, League of Red Cross Societies, Office International d'Hygiene Publique, Pan-American Sanitary Bureau, Provisional International Civil Aviation Organization, Rockefeller Foundation, United Nations Educational, Scientific and Cultural Organization, United Nations Relief and Rehabilitation Administration, and World Federation of Trade Unions.

[5] Australia, Brazil, Canada, China, Egypt, France, India, Liberia, Mexico, Netherlands, Norway, Peru, Ukraine, United Kingdom, United States, Union of Soviet Socialist Republics, Venezuela, and Yugoslavia.

The functions of the Organization are defined in Article 2 of its constitution:

In order to achieve its objective the functions of the Organization shall be: (a) to act as the directing and coordinating authority on international health work; (b) to establish and maintain effective collaboration with the United Nations, specialized agencies, governmental health administrations, professional groups, and such other organizations as may be deemed appropriate; (c) to assist governments, upon request, in strengthening health services; (d) to furnish appropriate technical assistance and, in emergencies, necessary aid upon the request or acceptance of governments; (e) to provide or assist in providing, upon the request of the United Nations, health services and facilities to special groups, such as the peoples of trust territories; (f) to establish and maintain such administrative and technical services as may be required, including epidemiological and statistical services; (g) to stimulate and advance work to eradicate epidemic, endemic, and other diseases; (h) to promote, in cooperation with other specialized agencies where necessary, the prevention of accidental injuries; (i) to promote, in cooperation with other specialized agencies where necessary, the improvement of nutrition, housing, sanitation, recreation, economic, or working conditions and other aspects of environmental hygiene; (j) to promote cooperation among scientific and professional groups which contribute to the advancement of health; (k) to propose conventions, agreements, and regulations, and make recommendations with respect to international health matters and to perform such duties as may be assigned thereby to the Organization and are consistent with its objectives; (l) to promote maternal and child health and welfare and to foster the ability to live harmoniously in a changing total environment; (m) to foster activities in the field of mental health, especially those affecting the harmony of human relations; (n) to promote and conduct research in the field of health; (o) to promote improved standards of teaching and training in health, medical, and related professions; (p) to study and report on, in cooperation with other specialized agencies where necessary, administrative and social techniques affecting public health and medical care from preventive and curative points of view, including hospital services and social security; (q) to provide information, counsel, and assistance in the field of health; (r) to assist in developing an informed public opinion among all peoples on matters of health; (s) to establish and revise as necessary international nomenclature of diseases, of causes of death, and of public health practices; (t) to standardize diagnostic procedures as necessary; (u) to develop, establish, and promote international standards with respect to food, biological, pharmaceutical, and similar products; (v) generally to take all necessary action to attain the objective of the Organization.

The work of the Organization shall be carried out by the World Health Assembly, composed of delegates representing the member nations and chosen from among persons most qualified by their technical competence in the field of health. This Assembly shall meet annually, and each nation shall have one vote. Territories not responsible for the conduct of their international relations may be admitted as associate members, representatives being chosen from technically qualified members of the native population.

An Executive Board, consisting of 18 persons designated by as many member nations and holding office for three years, shall act as the executive organ of the Health Assembly and give effect to the latter's decisions and policies. The Secretariat shall comprise the Director-General and such technical and administrative staff as the Organization may require. This includes the establishment of committees in various technical and other fields, as determined by the Board. The Director-General shall have direct access to national health organizations, governmental or nongovernmental.

The Health Assembly shall define the geographical areas in which it is desirable to establish regional organizations to meet special needs, each an integral part of the Organization. The Organization shall be brought into relation with the United Nations as one of the specialized agencies referred to in Article 57 of the Charter of the United Nations.

The first tasks of the World Health Organization undoubtedly will concern themselves with the age-old scourges of man, accentuated by the devastation of the war. The need is urgent for caring for the sick and wounded, for feeding the hungry, controlling epidemic diseases, and providing basic environmental sanitation. By pooling the resources, knowledge, and skills of all nations, elimination of such diseases as malaria, tuberculosis, and syphilis can be achieved.

Beyond the immediate needs, the World Health Organization looks forward toward leading the struggle in each country, with the help and encouragement of all other countries, of long-term programs of health services to protect the people from ravages of disease and to insure to every individual a standard of health compatible with the technical achievements of the medical sciences. And, using the broad definition of health, the goal of application of technical achievements to all men is not limited to physical well-being. Mental hygiene, in helping man to adjust to his environment, must be used in combination with education to prevent the insanity of another total war and to destroy the basic causes of war.

As Dr. Parran said in closing the International Health Conference on 22 July 1946: "The World Health Organization is a collective instrument which will promote physical and mental vigor, prevent and control disease, expand scientific health knowledge, and contribute to the harmony of human relations. In short, it is a powerful instrument forged for peace."

Teaching Personnel

M. H. Trytten
Director, Office of Scientific Personnel

A PERIOD OF GREAT SIGNIFICANCE lies ahead for higher education. Many developments now under way will become fixed habits of higher education; many expedients now adopted may become enduring weaknesses. The experiment of higher education for all is now in progress. In spite of the fact that this experiment will be tried under conditions of severe handicaps, its success or failure will greatly affect the public's attitude in the future. Success may lead to a very large measure of higher education for all, with sufficient support to eliminate most of these handicaps.

No element is as important in this connection as the quality of instruction accorded the students. This matter received much attention during discussions of the Round Table on Personnel Problems held in connection with the recent Emergency Conference on Higher Education of the American Council on Education, 11–13 July. A number of points were made which may be important enough to warrant attention from the educational public generally.

Colleges and universities appear to be caught in a web of circumstance making it hard to secure the services of competent instructors, particularly in the scientific and technical field. Traditional salaries are low. Many colleges hesitate to extend the privileges of tenure and retirement provisions to temporary employees. Housing provisions are generally inadequate, and transient faculty members can scarcely buy. Purchase prices for housing are extremely high for persons on college salaries. It seems likely that the pressure for teaching staffs will cause overloading of teaching schedules, thus nullifying many of the attractive features of academic life, such as freedom for research, study, and travel, and rich personal relationships with students which can only come if teaching loads are moderate enough to provide some time for leisure.

The round-table group was of the opinion that the manner in which colleges and universities meet this problem will have a large effect on the future well-being of American higher education. If the veteran's excursion into higher education is the rich, satisfying experience that it should be and if it leads to a competence that will possess reasonable market value, the American public will in the future be certain to back higher education for qualified youth. If the average veteran has a sour experience, the effect on the public's reaction to tax support for higher education is not likely to be salutary.

It must be remembered that the present crisis in personnel is only the first round. As the wave of enrollment passes on to higher classes, the degree of specialization of the curricula will rise and the diversity and technical difficulty of teaching will increase, requiring an abler and better-trained faculty than for freshman classes alone. At the same time, large freshman classes are to be expected for a few years yet.

It should be emphasized that colleges and universities can secure adequately trained staffs if a real attempt is made to compete with salaries offered by the two main competitors of education—industry and the Government. Many schools have already made provisions for a large share of their teaching staffs, and many have achieved full staffs. Even though the higher salaries offered in competing activities have lured many former teachers, and many good prospective teachers, from the academic path, it is generally recognized among industrial employers and among government administrators that it would be folly not to preserve the ability of the colleges and universities to produce highly trained personnel. These activities have a stake in the situation. It is believed that cooperation in making suitably trained personnel available for whole or part-time work could be counted on. However, a necessary first requisite is an adequate salary.

The dilemma of the colleges, then, is primarily one of being able to pay suitable salaries and offer conditions of service which will attract good men. That the Congress has recognized this is evident in the recent amendments to the Servicemen's Readjustment Act, which permits the Veterans' Administrator to pay to institutions the estimated total cost for veterans of teaching personnel and supplies instead of only the established tuition charges. Colleges and universities then can pay better salaries if necessary and can pass the costs on to the Federal Government. *This is in recognition of the fact that the Congress and not the colleges guaranteed the veteran an education.*

The reaction of administrators to the present situation appears to be a hesitation to raise salaries sufficiently to compete actively for proper personnel because of the fear of building up their salary scale to a level which might be hard to maintain if a slump in enrollments were later to occur or if the greater part of their income were later to be from other than veteran fees. This is, of course, a very real problem, and the attitude of the administrators is quite understandable. But it was pointed out by a number of administrators attending the round table that the other side of the picture should not be ignored. The report of 20 May 1946 to the President by the director of War Mobilization and Reconversion, entitled "The Veteran and Higher Education," predicts that higher education

enrollments will pass beyond the 3,000,000 mark by 1960. Veteran enrollment in the fall of 1947 will be greater than in the fall of 1946 and will not reach its peak until the fall of 1948. Not until 1950–51 will the number of veterans in college begin to decline significantly. It is confidently believed that after that period nonveteran enrollment will have increased and will continue to increase. This period is sufficiently long so that if a recourse is had to the employment of temporary, poorly qualified staffs, these staff members will have acquired a degree of permanence such that it will be difficult to replace them without doing some violence to the concept of tenure in college faculty employment. Inertia alone will tend to perpetuate them in their posts. It should not be necessary to add that this generation of veterans deserves well-qualified teachers.

In summary, it seemed to the members of this round table that higher education is at a crossroad. In one direction, that of temporary expediency, lies the road of poor instruction, poor public relations, and a long-time weakness in American life resulting from a poorly trained generation. In the other direction, that of a courageous insistence on qualified instruction regardless of cost, lies the road to success in the experiment of higher education for all, good public relations, and an adequately trained generation of veterans. It seemed to the members of the round table that education should have complete awareness of the implication of this situation.

Obituary

Velyien Ewart Henderson
1877-1945

The death of Prof. Henderson on 6 August 1945, at the age of 68, removed from the field of pharmacology and related medical sciences an outstanding teacher and critical investigator. An influential member of American scientific societies, this distinguished Canadian was long an officer of the American Society for Pharmacology and Experimental Therapeutics, of which he was president in 1936 and 1937. In 1936 he also served as president of the Federation of American Societies for Experimental Biology. A fellow of the Royal Society of Canada, he was president of the Biological Section in 1937, and in 1944 he was awarded its Flavelle medal for meritorious contributions to medical science. From 1941 to 1943 he was president of the Canadian Physiological Society, of which he was a charter member. He was also the founder of the Toronto Biochemical and Biophysical Society and its chairman in its second and twenty-first years.

Born and educated in Ontario, Dr. Henderson studied at Upper Canada College and in 1902 was graduated in medicine from the University of Toronto, the institution with which, except for a few post-doctorate years, he remained associated throughout his entire career. After a brief interest in a career in pathology and a period at the University of Pennsylvania, Dr. Henderson became a pupil of Hans Horst Meyer, then at Marburg. The impressions gained while under the tutelage of this great leader remained vivid throughout Dr. Henderson's life, and it was largely as a tribute to Meyer that he translated into English the seventh edition of *Experimental pharmacology,* the important textbook of Meyer and Gottlieb. After a few months with Starling in London, Dr. Henderson returned to the University of Toronto, where he was for a time in the Department of Physiology. He undertook the development of the Department of Pharmacology in 1906, at the age of 29, and became professor of pharmacology six years later. In 1914 he entered the Canadian Expeditionary Force as a combatant officer and was reluctantly transferred to the Medical Corps toward the end of the war, from which he returned as a major in 1919.

Prof. Henderson was extremely well versed in his subject and was gifted with a remarkable memory and unusual clarity of thought. An indefatigable teacher, he shouldered the lion's share of the responsibility for the instruction of the large medical classes by the staff of his Department. Lacking the facilities for student participation in other than very simple exercises in experimental pharmacology, he gave generously of his time by the presentation twice weekly throughout each school year of elaborate mammalian demonstrations chosen carefully to illustrate important pharmacological principles. Subsequently, photostatic copies of the kymographic tracings were presented to the students for detailed analysis, a practice much less enjoyed by the students than was the drama of the demonstrations.

In research, his interests were widely diversified, but he was particularly well known for his contributions

in the field of the chemical transmission of nerve impulses, for studies of the respiratory center, and for important and original discoveries in the field of anesthesiology. In 1922, with W. E. Brown, Prof. Henderson showed that ethylene is a more powerful anesthetic than nitrous oxide, and it was their work, together with that of Luckhardt and his associates in Chicago, which led to the development of ethylene as a general anesthetic agent. Investigations of many potentially valuable narcotic substances led to a study, with G. H. W. Lucas, of the pharmacology of propylene and to the discovery, while searching for possible toxic impurities in this gas, of the striking anesthetic properties of cyclopropane. The fundamental studies of this remarkable compound received prompt recognition, and cyclopropane was shortly introduced into, and widely applied in, clinical anesthesia.

He was one of Banting's closest friends and staunchest supporters during the days of the search for the antidiabetic hormone and provided Banting with a university post and laboratory facilities, in the year following the discovery of insulin by Banting and Best. He also had much to do with the effort to raise funds with which to endow the Banting Research Foundation. For 16 years he served as the secretary-treasurer of the Foundation, exercising unstintingly his keen judgment with regard to the significance of proposed research projects and the progress obtained under the support of the Foundation.

Prof. Henderson excelled in the training of graduate students, who found themselves exposed constantly to sincere interest, wide knowledge, and kindly but pungent guidance. He was particularly careful to direct the investigations of the advanced student into several relatively unrelated fields, in order to prevent a restriction of scientific experience and a narrowness of outlook that are all too often encountered in graduate training. By precept and example the student was trained honestly to persevere, to observe, and to evaluate.

Prof. Henderson was perhaps at his best in his home, where it was a real pleasure to join his charming family group. It was here particularly that one appreciated his wide cultural interests and his truly lovable nature. He was especially interested in architecture and painting. During recent summers at Georgian Bay he made many water-color sketches of wild flowers that were charming in design and color and gave him much pleasure.

His colleagues the world over mourn the passing of a distinguished investigator, a splendid teacher, and a noble man.

A. D. Welch
Western Reserve University, School of Medicine
Cleveland, Ohio

Technical Papers

Formation of Hyalite and Opal

Alcon C. Copisarow and Maurice Copisarow
1, Gildridge Road, Manchester, England

As in the case of mother-of-pearl, the optical properties of opal reflect the mode of its formation. In this respect the existing theories of opalescence constitute, however, a mere record of contrasting possibilities. Thus, L'Abbé Haüy (*6*) considered opalescence to be due to reflection from internal fissures; Brewster (*2*) attributed the display of color to the presence of microscopic cavities or minute air bubbles; and Behrens (*1*) assigned opalescence to the reflection from the thin, curved lamellae of opal, the refractive index of which may differ by 0.1 from that of the mass. These were conceived to have been formed originally in parallel position, but have been changed, bent, and finally cracked and broken in the solidification of the ground-mass.

There is considerable evidence to support the view that acidic silicic acid gels (pH value below 7.0) constitute an intermediate stage between the basic silicic acid gel and minerals of the hydrated silica type. This evidence includes the probable restriction of the monomolecular state to soluble silicates, molecular weight determinations, conditions of transition, the reduction of pH values with progressive gelation, and the general identification of coagulation with polymerization. In this light the soft, reactive basic silicic acid gel (pH value above 8.0) may be termed the *primary* or simple polymer of silicic acid; the elastic, inert acidic gel, the *secondary* or closely-linked complex polymer; and the hard, hydrated silica in the form of non-ionized minerals, *tertiary* polymers.

Recent work (*4*) on the rhythmic structures of silica and its hydrates led to the synthesis of the clear, opalescent and opaque forms of the acidic polysilicic acid gel under conditions specific to the Liesegang phenomenon. This, together with the consequent differentiation of these varieties by the presence and state of dispersion of silica particles within the colloidal

medium, have a direct bearing upon the present problem. The synthesis of these forms was preceded by the creation within the reaction medium of a whole series of diffusion regions with conditions alternating between those favoring and those adverse to peptization. This led to a corresponding periodic succession of transitions (to the inert acidic polymer) and decompositions (to silica and water) of the reactive basic silicic acid gel. The aggregation and orientation of the highly dispersed particles of silica were greatly influenced by experimental conditions resulting in semipermeable, porous, or impervious membrane bands. Again, under specific conditions the finely divided silica was carried in the upward movement of the acidic gel (a case of thixotropy), giving rise to the opalescence or opacity effect by the orientated deposition of laminar or fibrillar silica within the micellar structure of the medium. Apart from anomalies due to disturbing factors, it would seem that the network pattern of the silica orientation throughout the Liesegang phenomenon is primarily and fundamentally determined by the prototype structure of the colloidal medium.

This link between the various forms of the secondary polymer of silicic acid extends to the genetically and structurally related dehydration product, *i.e.* the tertiary polymer. Van Bemmelen (*8*) found that the gel of silica hydrate under the microscope appeared to have a cellular structure composed of a kind of network—Wabenstruktur—formed by the two solutions, the more concentrated forming the walls of a mass of cells, which enclose the other more dilute solution. This was confirmed by Bütschli (*3*), who also observed the accentuation of the network structure on drying the gel, as well as the fact that the natural opals exhibit a very fine cellular structure requiring the very greatest magnification to be rendered visible. Hydrophane, for example, with a magnification of 2,090 diameters, shows the cellular structure and is very little different from gelatinous silica. We thus perceive that all available evidence supports the observations and theory of Behrens. However, the results of the rhythmic separation of silica and its hydrates, outlined earlier, agree to the number but not to the character of opal constituents. Thus, Behrens' opal, a composite of two forms of opalite varying in density and refractive index, should be viewed as silica lamellae orientated within the network structure of a clear hyalite medium, which itself may be regarded as the pure tertiary polymer of silicic acid.

The formation of opal by the combination of external and internal (syneresis) pressure makes L'Abbé Haüy's theory hardly admissible. Any such fissures would be adventitious and a source of weakness.

As to Brewster's cavity theory, it seems to be untenable because of the fact that the appearance and general properties of the opalescent and opaque acidic silicic acid gel, the precursor of opal, were not affected by previous boiling and cooling *in vacuo* of the water-glass and the redistillation of the hydrochloric acid. These features of acidic silicic acid gels therefore were governed by osmosis and temperature conditions rather than by the presence of dissolved air in the reagents. In this respect a close analogy may be found in the rhythmic forms, especially the opacity bands, of calcium carbonate (*5*).

The formation of milky opal, opal agates, and chalcedony obviously fall within the scope of the present conception. It may be added also, that while the reactions outlined here no doubt find their prototype in nature, natural processes are not without variants, as may be seen in the function of organic life, superheated steam, carbon dioxide, and diffusion in connection with the formation of diatomite, flint, geyserite, chert, and gelatinous silicic acid (in the Alps) (*7*).

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The Metabolism of a Very Small Mammal

Peter R. Morrison and Oliver P. Pearson

Harvard University and *Swarthmore College*

It is well known that small mammals have a higher metabolism per unit weight than large ones. Thus, basal metabolic rates in Cal./kg. day ranging from 12 for the steer to 170 for the white mouse have been observed (*1*). The latter, with an average weight of 20 grams, is the smallest adult mammal on which metabolic studies have previously been made.[1] We have now made measurements on a shrew whose weight averages less than one-fifth that of the white mouse and thus is at the lowest limit of mammalian size.

The specimen used was a rather large, anestrous, female long-tailed shrew, *Sorex cinereus cinereus* Kerr, captured on Cape Cod and weighing 3.5 grams. It was extremely active, ate large quantities of worms and insects, and in all ways seemed entirely normal

[1] This excludes the "dwarf" mouse (8 grams), an endocrinologically defective strain of white mouse. Crude measurements on "a dormouse" of 6–7 grams (*5*) and measurements at low temperatures on a bat, *Pipistrella* sp. of 4–8 grams (*4*), both hibernators, have been reported.

when compared with other captives of the same species. Its oxgyen consumption was measured in an automatic, volumetric apparatus to be described in detail elsewhere. The conditions of measurement were adjusted to simulate natural conditions, with ample food and water, a commodious chamber (1 liter) free from noises or drafts, and a moderate temperature. Carbon dioxide and water vapor were absorbed on soda lime and saturated calcium chloride, and the time required to empty a small (10 cc.), automatically refilled spirometer of oxygen was recorded kymographically. The sensitivity of the method was ±1 per cent. Oxygen and carbon dioxide concentrations above 17 and below 2 per cent, respectively, were maintained.

TABLE 1

OXYGEN CONSUMPTION IN *Sorex*

Food	Hours	°C.	Oxygen* consumption (cc./gram hr.)		
			Min.	Av.	Max.
Yes	12	24	10.9		19.3
Yes	24	27	11.2	16.8	21.5
Yes	24	26	10.6	14.4	18.9
No	11	29	13.7		18.9

* As dry gas at S. T. P.

One 12-hour and two 24-hour runs were made at 24–27° C., during which the animal appeared to be as comfortable as when in its terrarium. These runs were composed of 245 individual periods of 9–25 minutes duration. They revealed a continuous series of short activity cycles averaging 1.4 hours in length. A digestive cycle of less than 2 hours has been observed in *Cryptotis,* another tiny shrew (*3*). During the night these cycles tended to fuse into continuous activity, with an average oxygen consumption 20 per cent higher than during the day.

In an attempt to obtain postabsorptive measurements a fourth run without food was made at 29° C. The animal died, presumably of starvation, after 11 hours, but at no time until the period immediately before death did it consume oxygen more slowly than in the other runs. During this 11-hour fast the shrew used 620 cc. of oxygen. Assuming a body composition similar to that of the white mouse (*2*) with 1.5 Cal./gram, this represents an energy consumption of 54 per cent of the shrew's metabolizable body substance. The loss in total body weight during this period was 12 per cent.

Values for the minimum, average, and maximum rates of oxygen consumption are shown in Table 1. Assuming a value of 4.60 Cal./liter for the caloric equivalence of the oxygen consumed by this carnivorous animal (fat, 4.69; protein, 4.49), the average daily rate of 15.6 cc./gram hour represents 1.72 Cal./gram day. With such a high metabolic rate this tiny shrew must literally eat its own weight every day in order to live. At the maximum intensity observed, 21.5 cc./gram hour or 2.37 Cal./gram day, the shrew consumed 1 per cent of its metabolizable body substance in 10 minutes. Under conditions of "severe" work, oxygen consumption in man is about 2 cc./gram hour (*6*), or one-tenth of the above value.

Because of this animal's extreme nervousness and constant need for food, measurements of basal metabolism comparable to those on other mammals will not be readily obtained. Even the white mouse, which is slothful and lethargic compared to *Sorex,* has been considered difficult (*2*), but we feel that our conditions have been particularly conducive toward repose. Nevertheless, we might expect to obtain lower minimum values in runs with food under conditions of smaller volume, shorter measuring periods, and perhaps a higher temperature, although observations indicate that even moderately high temperatures may be disturbing to *Sorex.*

TABLE 2

THE BASAL METABOLISM OF VARIOUS MAMMALS COMPARED TO *Sorex*

Animal	Weight kg.	Basal metabolism in Cal. per		
		kg. day	sq. m. day	$kg.^{0.73}$ day
Steer*	500.	12†	1,090†	65†
Man*	65.	25	920	78
Macaque*	4.2	49	670	73
Guinea pig*	0.41	86	710	68
White mouse* ...	0.021	170	530	61
Blarina‡	0.020	370	1,020	130
Sorex	0.0035	830§	1,570§	183§

* See (*1*).
† Corrected for standing and activity.
‡ Unpublished observations
§ Corrected for "digestive activity."

The lowest rate of oxygen consumption observed was 10.6 cc./gram hour, or 1.17 Cal./gram day. Since it is probable that this animal is never resting and postabsorptive at the same time, correction will be made for "digestive activity" when comparing *Sorex* to other mammals. A factor of 0.71 is obtained by comparing the minimum values in runs on mice (*Peromyscus, Evotomys, Pitimys*) and a larger shrew (*Blarina brevicauda*), with and without food (unpublished observations). In Table 2 this corrected value is compared to those of a representative series of mammals, and it may be seen that in terms of basal metabolism this tiny insectivore with the weight of a dime is equivalent to "half a pound of beef." The surface area of this individual was 18.5 sq.cm., and the basal metabolism is also compared as Cal./sq.m. day. It is further compared as Cal./$kg.^{0.73}$ day, a function which is roughly constant for most mammals. The value of 183 obtained for *Sorex* seems high, but unpublished observations on *Blarina* (Table

indicate that shrews as a group may have a higher basal metabolism than other mammals. Further, since *Sorex* represents an extreme in size, it is entirely possible that it will deviate from the function which relates other mammals.

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The Milk Factor in Blood

SAMUEL GRAFF, HENRY T. RANDALL, GRAY E. CARPENTER, and CUSHMAN D. HAAGENSEN

Departments of Biochemistry and Surgery, College of Physicians and Surgeons, Columbia University, New York City

Bittner's (*1*) discovery that a mammary tumor-inciting agent is present in the milk of high tumor strain mice ushered in a series of researches aimed at the eventual isolation and characterization of this extrachromosomal factor. As a preliminary to isolation experiments we undertook the investigation of mouse blood with special attention to the serum component.

TABLE 1*

Fraction tested	No. of mice	No. of tumors	
Whole blood	20	1	5% ± 4.87%. Age, 11.8 mos.
Washed red cells ...	13	0	
Hemolyzed and dehydrated red cells ..	4	0	
Whole serum	47	0	
Fat-free whole serum	16	0	
Serum globulins	83	0	
Serum albumins	21	0	
Neutral fats	14	0	
Total	218	1	Mean age at death of 217 tumor-free mice, 24.4 ± .07 mos. S.D., 1.18 ± .05 mos.

*Only animals surviving six months or more appear in this table.

Woolley (*3, 4*) had found the agent to be present in the whole blood of his strains, in concentrations suggestively similar to its concentration in milk.

In our experiments whole blood was obtained by heart puncture from 100 mature etherized female Paris mice, whose tumor incidence in our laboratory has been 92.9 ± 1.84 per cent in bred female controls. All blood samples were pooled, and serum and serum fractions were prepared in the appropriate manner from this pool. Single doses of 0.2 cc. of whole blood or serum, or serum fraction equivalent to 0.2 cc. serum, were injected subcutaneously into young female C57 test mice, a strain in which there have been no spontaneous mammary carcinomata during the past five years in our laboratory. This strain has proved highly susceptible to the milk factor, developing 76.1 ± 4.34 per cent carcinoma of the breast in females by foster nursing (*2*). The injected mice were subsequently bred and allowed to bring up their young normally under our standard control conditions. The final results appear in Table 1.

The fact that no tumors appeared in the series treated with whole serum is a definite negative answer to any hope of using serum for the isolation of the agent. All serum fractions gave results consistent with those of whole serum. The appearance of one tumor in 20 mice treated with whole blood is probably significant, but the incidence shown is less than that obtained by Woolley with whole blood.

Whole blood and blood fractions do not appear to be a rich source of the milk factor.

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Colistatin: A New Antibiotic Substance With Chemotherapeutic Activity

G. F. GAUSE

The Institute of Tropical Medicine, Moscow, USSR

Among antibiotic substances inhibiting growth of gram-negative bacteria, streptomycin, produced by *Streptomyces griseus* (*6*), appears to be particularly interesting at the present time. It was observed by us that some strains of aerobic sporulating bacilli isolated from soil, while growing upon the surface of nutrient agar containing tryptone and glucose, produce a well-diffusible antibiotic substance inhibiting growth of staphylococci as well as of *Bacterium coli*. While growing upon the liquid medium, these bacteria form heavy surface pellicles, and the antibiotic diffuses into the nutrient broth. However, this antibiotic substance is thermolabile and is strongly inactivated by boiling the culture liquid in the water bath for 15 minutes.

After detailed examination of a large number of cultures isolated from chernozem soils, an aerobic sporulating bacillus was found by us which produces a thermostable antibiotic substance, inhibiting the growth of *Staphylococcus aureus* as well as of *B. coli*. The activity of this substance is not decreased by boiling the culture fluid for 15 minutes. Because of its

bacteriostatic action upon *B. coli,* this substance may be designated as *colistatin.*

Bacteria producing colistatin in a tryptone-glucose medium also form a bright yellow pigment which is devoid of antibiotic action. When the bacteria are grown in a shallow layer of nutritive liquid for three days at 28° C. and the culture fluid is poured off (free of bacterial pellicle) and acidified by HCl to pH 3.5, a flaky precipitate is immediately formed, whereas all the activity remains in the clear filtrate. Hence, colistatin differs essentially from tyrothricin (*2*) and gramicidin S (*3*), which are precipitated by acid. When a clear filtrate containing colistatin is treated by 0.5 per cent charcoal at acid reaction, the yellow pigment is adsorbed upon the carbon, whereas the active antibiotic substance remains in the colorless filtrate. Colistatin cannot be extracted from the culture liquid by butanol, and in this respect it evidently differs from bacitracin (*4*).

Colistatin inhibits staphylococci more strongly than *B. coli.* Taking the activity against *Staph. aureus* as a standard, the unit of colistatin may be defined as that amount of the substance which is just sufficient to inhibit completely the growth of staphylococci in 1 ml. of nutritive broth for 20 hours at 28° C. When bacteria producing colistatin are grown upon tryptone-glucose medium, on the third day of growth the concentration of colistatin attains 200 units/ml. of the culture fluid. On the mineral medium, with 1 per cent of glucose, its concentration attains 1,000 units, and with 3 per cent of glucose, correspondingly, 2,500 units/ml. Colistatin is equally effective in agar or broth; its activity is not affected by the addition of 10 per cent of human blood serum to the nutritive medium; and while dissolved in agar, it rapidly diffuses into water.

For the production of colistatin the following medium is used: glucose, 30 grams; $NaNO_3$, 3 grams; KH_2PO_4, 1.5 grams; $MgSO_4$, 0.5 gram; $FeSO_4$, 15 mg.; tryptone, 1 gram; tap water, 1 liter; pH 6.5; and growth for 3 days at 28° C. in shallow layers of medium. At 37° C. the production of colistatin is decreased, and its isolation from the culture fluid by the methods outlined below cannot be attained.

It was recorded that colistatin possesses some properties in common with streptomycin and can be isolated and purified in the following manner: Culture liquid, free of bacterial pellicle, is acidified to pH 3.5, treated by 0.5 per cent of charcoal at acid reaction (colistatin is not adsorbed upon carbon in acid medium), filtered, neutralized, and treated by 1.5 per cent of charcoal at neutrality. Colistatin is completely adsorbed on charcoal at neutral reaction and can be eluted from it by 80 per cent aqueous ethanol at acid reaction (pH 5.0). The eluate is neutralized, and ethanol removed *in vacuo* at 50° C. The remaining liquid represents a concentrated aqueous solution of partially purified colistatin. It is clear that the method of concentration and partial purification of colistatin employed by us is reminiscent of the preparation of streptomycin (*1*).

A further study of the chemical properties of colistatin also revealed in its behavior some features in common with streptomycin. When a concentrated aqueous solution of colistatin is evaporated *in vacuo* just to dryness, the residue appears to be quite soluble in acid methanol, less so in acid ethanol, and insoluble in butanol. From the acid methanol solution, colistatin is precipitated by ether. However, these manipulations are associated with a partial loss of the activity of colistatin.

Colistatin can easily be obtained in the active form. After pretreatment of the culture fluid by charcoal at an acid pH, and adsorption of colistatin upon neutral charcoal, the latter is shaken energetically for 15 minutes in 4 volumes of acid methanol (containing 0.5 ml. of HCl/100 ml. of methanol). This treatment elutes colistatin from the carbon. The eluate is immediately neutralized by sodium bicarbonate to pH 6.5, concentrated *in vacuo* to one-tenth of the original volume, and filtered through a thin layer of kaolin. Colistatin, which is now contained in the filtrate, can be precipitated from the latter by 7 volumes of acetone. As has been shown, the same procedure can be employed satisfactorily in the preparation of streptomycin (*5*).

A concentrated aqueous solution of colistatin is not toxic for white mice by subcutaneous, intramuscular, or intravenous injections at a concentration of 100,000 units/kg. The chemotherapeutic properties of colistatin were tried on mice infected by the spirochete of relapsing fever (*Borrelia sogdianum*). On the day following infection, one-half of the mice received three intramuscular doses of colistatin (30,000 units/kg. in each dose, distributed at three-hour intervals). On the day following treatment, the blood of all control mice contained spirochetes, which were totally absent in the blood of all mice treated with colistatin.

In contradistinction to streptomycin, colistatin possesses purely bacteriostatic action and is devoid of bactericidal power. Colistatin inhibits the growth of staphylococci, pneumococci, *B. coli, B. proteus, B. paratyphosus B., B. dysenteriae Shiga,* and *B. typhi abdominalis.*

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News and Notes

About People

Amedeo S. Marrazzi, head of the Department of Pharmacology and Therapeutics, Wayne University College of Medicine, has been given an additional grant of $2,500 by the Smith, Kline and French Laboratories to continue his studies by electrical methods of drugs acting on the autonomic and central nervous systems.

Richard S. Burington, director of the Evaluation and Analysis Groups, Research and Development Division, Bureau of Ordnance, Navy Department, Washington, D. C., has been named chief mathematician, Bureau of Ordnance.

David L. Arm became dean of the School of Engineering, University of Delaware, on 1 July. He comes from Iowa State College, where he was head of the Mechanical Engineering Department, as well as director of the Navy's Diesel Engine School for the past several years.

Oscar Riddle, formerly staff member of Carnegie Institution's Department of Genetics and for the past nine months a visiting professor to five South American republics under the auspices of the Department of State, has returned to this country and is residing in Plant City, Florida.

Lt. Col. Hubert G. Schenck, Corps of Engineers, AUS, has received the Legion of Merit for his work as chief of the Natural Resources Section, General Headquarters, Supreme Commander for the Allied Powers, in Japan.

George B. MacWood has resumed his teaching in the Chemistry Department, The Ohio State University, with advancement to the rank of associate professor, after being on leave at the Radiation Laboratory, University of California, during the war. Two new assistant professors, Thor Rubin and Harry H. Sisler, were recently appointed for work in general chemistry.

Ernest Sachs, a member of the faculty of Washington University School of Medicine, St. Louis, for 35 years, has retired as professor of neurological surgery to become professor emeritus. He will continue his work at Barnes and Children's Hospitals and will also continue to train graduate students in neurological surgery.

Arthur E. Ruark has resigned as head of the Department of Physics, University of North Carolina, to join the staff of the Applied Physics Laboratory, The Johns Hopkins Hospital.

Paul Buchner, formerly of the University of Leipzig and authority on cellular symbiosis, has been living with his family on the island of Ischia since before the invasion of Italy. Prof. Buchner's wife and son are Italian citizens. Since the departure of the English Army from the island the entire family has been without both work and income and is now existing near starvation level. Although Prof. Buchner could not do any zoological work during the war years, he continued his prehistoric and archeological survey of the island, and with the help of the English has founded a small museum built around his material. He is now in danger of being evicted from his house as an alien. Since he cannot return to Germany and cannot work in Italy, his plight is extreme. His address is Porto d'Ischia, Via San Alessandro, Italy.—*Richard B. Goldschmidt* (University of California).

Thomas H. Bissonnette, Trinity College, Hartford, Connecticut, has recently been awarded the Walker Grand Honorary Prize of $1,000 by the Boston Society of Natural History for his work on photoperiodism. This prize was established in 1864 by William J. Walker, a physician of Boston and Newport and one of the eminent early members of the Society. It is given once every five years for a scientific investigation or discovery of extraordinary merit in the field of natural history.

Samuel Lenher, of the Chambers Works of the Du Pont Company, Deepwater Point, New Jersey, has been appointed director of manufacture for the dyestuffs division of the Company, with headquarters in Wilmington. Dr. Lenher will assume this newly-created position in the Organic Chemicals Department on 1 October.

Walther Arndt, curator, Zoological Museum, Berlin, was sentenced by the Nazi "People's Court" and executed on 26 June 1944, according to news received by Ernst Schwarz, U. S. National Museum, from Ernst Matthes, professor of zoology, University of Coimbra, Portugal. There was no racial bias against him but, according to Dr. Matthes, "he had the courage not to conceal his disagreement with the Nazi way of thinking."

Dugald Brown, acting dean of New York University's Dental College for the last two years, was appointed director of the Bermuda Biological Station on 13 July. The research staff, in addition to its director and Hilary Moore, resident naturalist, will consist of visiting investigators working on grants from univer-

sities and foundations or on fellowships provided by the Biological Station.

Icie Macy Hoobler, director of the research laboratory of the Children's Fund of Michigan, spoke on the "Romance of Research" at a dinner on 11 September before receiving the Francis P. Garvan medal honoring women in chemistry. Dr. Hoobler pointed out that nutritional deficiencies directly or indirectly disqualified about one man in seven. She regretted that the calamity of war was necessary to bring this matter to the attention of the general public.

Jose R. do Valle, professor of pharmacology at the Instituto Butantan, São Paulo, Brazil, has been awarded a Guggenheim traveling fellowship for study in leading pharmacological laboratories in the United States. After several months in the laboratories of the University of Texas Medical Branch, Galveston, Dr. do Valle is visiting the laboratories of Herbert M. Evans and Hamilton H. Anderson, of the University of California Medical Center, and will later work with E. M. K. Geiling, of the University of Chicago. While at Galveston, Dr. do Valle worked with C. M. Pomerat in the Tissue Culture Laboratory and with George Emerson and Paul Ewing in the Pharmacology Laboratory.

Albert P. Doerschuk, recently returned from two years Army service, is the recipient of a junior research fellowship, established by the Corn Products Refining Company in the Department of Chemistry, University of Pittsburgh.

Leroy E. Loemker, head of the Department of Philosophy, Emory University, has been named dean of the Emory Graduate School. Dr. Loemker assumed his new duties on 1 September, succeeding J. Harris Purks, dean of the College of Arts and Sciences, who has filled the position in an acting capacity for several years.

Clarence E. de la Chapelle, assistant dean and director of the Postgraduate Division of New York University College of Medicine, has been appointed associate dean of the College.

William S. Carlson assumed the presidency of the University of Delaware on 1 July. Before going to Delaware, Dr. Carlson was dean of records and professor at the University of Minnesota. He is the author of *Greenland lies north,* based on his experiences in the Arctic.

Announcements

Chromosoma and *Zeitschrift für Zellforschung und mikroskopische Anatomie,* two biological publications of an international scope, will resume publication. The two journals, the former devoted to cytogenetics, will be published again by Springer, but will now be issued from Vienna instead of Berlin as before the war. All manuscripts should be sent to Prof. J. Seiler, Zoological Institute, Eidg. Technische Hochschule, Zürich, Switzerland.

The physical chemistry of drug action will be studied in a new research project established at Northwestern University, according to R. K. Summerbell, chairman of the Department of Chemistry. Under the direction of Irving M. Klotz, the study will consist of the structural and environmental factors which influence the combination of enzymes and proteins with drug molecules. The project has been made possible through a contract with the Office of Research and Inventions of the Navy Department and will extend over a period of two years.

A 300-pound glass telescope prism will be installed in the world's largest Schmidt-type telescope at the Observatorio Astrofisico Nacional, Tonanzintla, Puebla, Mexico. This prism, the largest yet made, will be used for auxiliary equipment to photograph stellar spectra more than 100,000 times fainter than the faintest star visible to the naked eye. The prism was ground and polished by the Perkin-Elmer Corporation, Glenbrook, Connecticut, from a 379-pound optical glass molded at the Bausch and Lomb Optical Company, Rochester, New York, and exceeds by three inches the next largest one of its kind at the Case School of Applied Science, Cleveland.—*Science Service.*

The School of Mathematics, Institute for Advanced Study, is planning to allocate a small number of stipends to persons having a background in mathematics and mathematical physics to enable them to study and to do research work at Princeton University during the academic year 1947–48. Candidates must have given evidence of ability in research comparable at least with that expected for the Ph.D. degree. Blanks for application may be obtained from the School of Mathematics, Institute for Advanced Study, Princeton, New Jersey, and are returnable by 1 February 1947.

The Pabst Brewing Company has announced an expanded program of research under the direction of Alexander Frieden. A three-story research building is now under construction at Milwaukee. The first floor is to house offices and pilot plant; the second, the Theoretical Laboratories; and the third, the Applied Laboratories. There will be enlargement and expansion of the work of the present groups, consisting of the Bacteriological Laboratory, headed by J. C. Hoogerheide; the Biochemical Laboratory, headed

by Harold Levine; the Physical Chemistry Laboratory, headed by W. D. Claus; the Organic Chemistry Laboratory, headed by S. A. Morell; and the Chemical Engineering Laboratory, headed by P. Deren. Also, a new laboratory on fundamental studies of flours and starches is under consideration. The Applied Laboratories will contain units on textiles, paper, adhesives, and food and will work on the application of the products the Company is now manufacturing as well as those it develops for textile and paper mills, for the manufacture of adhesives, and in the food industry.

A Department of Illustration will open at Washington University School of Medicine, St. Louis, this fall under the direction of K. Gramer Lewis, a professional photographer formerly with the Photographic Department at the State University of Iowa. The new Department will offer a complete medical photographic service, including clinical photography, photomicrography, and motion pictures.

The first postwar meeting of Southwestern archeologists was held on 20–22 August in Santa Fe, New Mexico, under the chairmanship of E. W. Haury, of the University of Arizona. The sessions, held at the Laboratory of Anthropology, were attended by 45 anthropologists representing 14 institutions. A summary of the meeting is to appear in *American Antiquity,* and a more extended report in *El Palacio,* organ of the Museum of New Mexico, Santa Fe.

A program for peacetime scientific training of Quartermaster Corps reserve officers was inaugurated in Chicago by the Quartermaster Food and Container Institute in July, when 25 young men began a three-year program of graduate study in scientific fields at the University of Chicago, Iowa State College, and Northwestern University, under the auspices of The Quartermaster General, U. S. Army. Col. Charles S. Lawrence, commanding officer of the Institute, located at 1849 West Pershing Road, Chicago, is responsible for the correlation of the students' work at the universities with the Army's program of research and study. The Institute, which collaborated with colleges and industry during the war on the development of all special food requirements for the armed forces, expects to continue such collaboration.

This is a plan on the part of the Army to assist in the education of a group of scientists who will be available to industry upon completion of the course so that the problems of food and packaging research of the armed forces can be more closely identified with industry. It will combine graduate study at one of the three universities with actual laboratory work at the Institute on special projects, assigned in connection with food and container research.

The majority of the men, selected jointly by the staffs of the Institute and the universities, are returned veterans of World War II. All have been commissioned reserve officers in the Quartermaster Corps, regardless of the branch in which they saw active service during the war, and while on duty will receive the full pay and allowances of their respective ranks. In addition, all tuition, equipment, and laboratory fees will be paid by the War Department. Those selected bring to the Army a valuable and varied educational background of undergraduate and graduate study at 30 different universities in the fields of mathematics, psychology, bacteriology, economics, biology, physics, chemistry, nutrition, agricultural economics, and physiology. Successful completion of the course of study may not only result in a Master's degree but may lead to a doctorate. Upon finishing the course, they will revert to civilian status and can be called to active duty only for a national emergency.

A new organization for research in gastroenterology and internal medicine has been worked out jointly by the Samuel S. Fels Fund Medical Research Laboratory and Temple University School of Medicine. The Fels Research Laboratory will henceforth be known as the Fels Research Institute of Temple University School of Medicine and will be located in the Medical School laboratory building at Broad and Ontario Streets. According to the agreement approved by the representatives of the agencies, the Samuel S. Fels Fund will furnish the laboratory equipment and will finance the research program covering staff salaries and the Institute's operating expenses. The management committee of the Institute will consist of an equal number of members appointed by the cooperating groups. The Temple University members will include Robert L. Johnson, president of the University; William N. Parkinson, dean of the School of Medicine; Charles L. Brown, head of the Department of Medicine; and Robert L. Hamilton, chairman of the Medical School Committee on Research. The Fels members are to be designated by their board.

Harry Shay, who has been in charge of the Fels Research Laboratory since its establishment in 1934, will continue as director of the new Institute. The culmination of the plan just accepted has been made possible by Samuel S. Fels, manufacturer, who is well known for his deep interest in science.

The American Standards Association has released a catalogue of 845 standards including definitions of technical terms, specifications for metals and other materials, dimensions, safety provisions for the use of machinery, methods of work, and methods of test for the finished product. The 154 American War Standards listed on pages 15 and 16 of the booklet are now being reconsidered for their possible value as American Standards in connection with peacetime

production. The catalogue will be sent free of charge to anyone interested. Requests should be addressed to the American Standards Association, 70 East 45th Street, New York 17, New York.

The Eli Lilly and Company Award in Bacteriology and Immunology, amounting to $1,000 and a medal, was presented to Maclyn McCarty, Rockefeller Institute for Medical Research, at the 46th general meeting of the Society of American Bacteriologists held recently in Detroit. This was the ninth award of this recognition, which is governed by joint committees of the American Association of Immunologists, the American Society for Experimental Pathology, and the Society of American Bacteriologists. Previous recipients have been Harry Eagle, Frank L. Horsfall, Jr., Jerome T. Syverton, John G. Kidd, Dilworth W. Wooley, Alwin M. Pappenheimer, Harlan G. Wood, and Esmond E. Snell. At the same meeting Dr. McCarty spoke on "Chemical Nature and Biological Specificity of the Substance Inducing Transformation of Pneumococcal Types."

I. G. Farben research in acetylene chemistry will be investigated and evaluated by a team of scientists, according to an announcement by the Chemicals Unit of the Technical Industrial Intelligence Branch, Department of Commerce. Among the German cartel's new developments which have aroused the active interest of American industry are plastics, drugs, pharmaceuticals, surface active agents, adhesives, synthetic detergents, and gums. Costs will be shared by the companies with which the investigators are affiliated. The findings will be made public through the Office of the Publication Board, Department of Commerce.

Two members of the team, Horace M. Weir and D. L. Fuller, both of the General Aniline and Film Corporation, left for Germany at the end of June. While in Germany, Dr. Weir was also to study the Linde-Frankl oxygen process for Hydrocarbon Research, Inc., New York City.

The following members left during July: A. O. Zoss, General Aniline and Film Corporation, Easton, Pennsylvania; G. B. Carpenter, Air Reduction Company, Stamford, Connecticut; and Karl Kammermeyer, Publicker Industries, Inc., Philadelphia.

Two members of the team, Edward N. Rosenquist and Wayne E. Alexander, both with the Monsanto Chemical Company, St. Louis, were already at work in Germany when the others arrived.

The Department of Physics, University of California, Berkeley, announces the following appointments for 1946–47: Wilson Powell, associate professor; Wolfgang Panofsky, assistant professor; William B. Fretter, instructor; and H. R. Snodgrass, associate. In addition to these men, L. W. Alvarez, E. M. McMillan, and J. R. Oppenheimer are now resuming their teaching duties after extended leave of absence for war work, restoring the entire prewar permanent staff of the Department.

Princeton University began celebration of its bicentennial on Monday, 23 September. In all, 15 conferences are scheduled throughout the academic year, and the event will be culminated on 14 June 1947, when President Truman will speak at the commencement exercises. The titles and dates of the conferences, of which there are to be two series, follow: "The Future of Nuclear Science," 23–25 September; "The Chemistry and Physiology of Growth," 27–30 September; "Engineering and Human Affairs," 2–4 October; "The Evolution of Social Institutions in America," 7–9 October; "The Development of International Society," 11–14 October; "The Humanistic Tradition in the Century Ahead," 16–18 October; "University Education and Public Service," 13–14 November; "The Problems of Mathematics," 17–19 December; "Genetics, Paleontology and Evolution," 2–4 January 1947; "The University and Its World Responsibilities," 19–21 February; "Planning Man's Physical Environment," 5–6 March; "Near Eastern Culture and Society," 25–27 March; "Far Eastern Culture and Society," 1–3 April; "Research and Scholarship in the Arts," 22–24 April; and "Secondary School Education," 14–15 May.

The planners of the conferences are limiting themselves to the lecture form of presentation. They have arranged that much of the time be spent in discussions from the floor of the conferences by others, competent in the various fields.

From 23–25 September addresses were given by Niels Bohr, P. A. M. Dirac, Hugh S. Taylor, Enrico Fermi, Albert Einstein, H. C. Urey, James B. Conant, and P. M. S. Blackett.

The conference beginning on 27 September will be devoted to "The Chemistry and Physiology of Growth." Those participating will be: John H. Northrup, C. B. Van Neil, Herbert Evans, C. P. Rhoads, Karl Folkers, and H. Holter.

The third conference, beginning 2 October, will be entitled "Engineering and Human Affairs." Speakers will include Joseph E. Pogue, Charles M. Stine, Sir Harold Hartley, David Sarnoff, Karl Compton, Zay Jeffries, Robert Wilson, and Vice-Adm. Ben Morrell.

The Committee on Research in Comparative Physiology Under Natural Conditions (see *Science,* 1946, **104**, 110) has been announced as follows: Laurence Irving (chairman), W. H. Forbes, F. E. J. Fry, G. E. Hutchinson, Ancel Keys, A. C. Redfield, and D. R. Griffin (secretary). Dr. Griffin may be addressed at

the Department of Zoology, Cornell University, Ithaca, New York.

The Committee will review and approve programs of research and refer them to interested government agencies and international organizations. A symposium on methods and results of physiological field work will be held during the spring of 1947. In addition, the Committee hopes to establish fellowships, grants, and eventually a central laboratory devoted to the development of methods and the training of personnel for field work of a physiological nature.

Speaking at the 25th anniversary of the Petroleum Division of the American Chemical Society in Chicago on 10 September, Bruce K. Brown, of the Standard Oil Company of Indiana, predicted a new peak in the use of petroleum in the next quarter of a century even though the use of the nuclear pile for the production of power becomes common. Dr. Brown said that there is no danger of an oil famine during this period because the United States still has proven oil reserves in excess of 20,000,000,000 barrels, and that the reserves of natural gas are seven times greater than they were 25 years ago. Liquid fuel can be made from gas as well as from coal and shale. Dr. Brown went on to point out: "If we were to draw from only one-third of our present known gas reserves at the rate of 4 per cent per annum, we could produce 500,000 barrels a day of gasoline by variations of the Fischer-Tropsch process. Natural gas is the cheapest raw material from which to synthesize liquid petroleum by the Fischer process, but it is technically feasible to conduct the synthesis using hydrogen and carbon monoxide gas produced from coal at a somewhat higher cost and, so far as I know, no one has yet begun to worry about the depletion of our 2,000-year reserve of coal. Further, we have always available the 92,000,000,000 barrels of oil in shale."

New appointments at Reed College, Portland, Oregon, have been announced as follows: Josef F. Burnett, assistant professor of organic chemistry; Lewis H. Kleinholz, assistant professor of biology; and Frank P. Hungate, instructor in biology.

A 100-year index of publications of the California Academy of Sciences is being compiled and will be issued on the occasion of the Academy's Centennial in 1953. Since the *Proceedings of the California Academy of Sciences* were published out of series and unnumbered from 1876 to 1888 and the record of these was destroyed in the San Francisco fire in 1906, the Academy cannot be sure that it has a complete list of all its publications. Anyone having knowledge of scientific papers published by the Academy between 1876 and 1888 is urged to communicate with Miss Veronica Sexton, Executive Librarian, California Academy of Sciences, Golden Gate Park, San Francisco 18.

The National Registry of Rare Chemicals, Armour Research Foundation, 35 West 33rd Street, Chicago 16, Illinois, lists its new needs in the following list of chemicals: potassium pyrosulfate; triolein, trilinolein; cis and trans 1,2-dichloroethylene; adoninulose; methyl ethyl ether; Witte's peptone (1 lb.); neovaleraldehyde; ferric cyanide; erythroidine; uranyl formate; indium telluride; indium selenide; o-tolyl urethane; perseitol; perseulose; l-erythrulose; xanthopterin; saccharic acid; and 3,5-dihydroxytoluene.

The Tennessee Agricultural and Industrial State College, Nashville, has been awarded a grant of $2,500 by the Research Corporation of New York to assist in the development of a research problem involving studies of ketenes and their derivatives. The project is to be carried out under the supervision of Carl M. Hill, head of the Department of Chemistry, with the assistance of Myron B. Towns, Thomas C. Goodwin, and Mrs. Mary E. Hill. The grant carries provision for two undergraduate fellowships and one assistantship. Research activities under the grant commenced on 1 September.

The California Institute of Technology has announced new appointments in its Division of Biology as follows: Marguerite Fling, Mrs. M. B. Houlahan, J. F. Nye, and Bernhard Phinney, research fellows in chemical genetics; Daniel L. Harris, Eli Lilly research fellow in chemical genetics; N. H. Horowitz and H. K. Mitchell, senior fellows in research in chemical genetics; E. B. Lewis, instructor in genetics; W. K. Maas, Ray D. Owen, and Herschel Roman, Gosney research fellows in genetics; Adrian M. Srb, R. P. Wagner, and Arthur H. Whitley, National Research Council fellows in serological genetics, genetics, and embryology, respectively.

Washington University School of Medicine, St. Louis, has announced the following appointments and promotions, effective on 1 July: Robert A. Moore (head of the Pathology Department), as acting dean; Philip A. Shaffer (retiring dean), as Distinguished Service professor of biological chemistry; Carl Cori (professor of biological chemistry), as head of the Department of Biological Chemistry; Carl V. Moore (medicine), Richard S. Weiss (clinical dermatology), Henry G. Schwartz (neurological surgery), Mildred Trotter (anatomy), and James L. O'Leary (neurology), to professorships; and Alfred D. Hershey (bacteriology and immunology) and Wendell G. Scott (clinical radiology), to associate professorships.

As was previously announced, Hallowell Davis, di-

rector of research for the Central Institute for the Deaf, has been appointed research professor of otolaryngology and associate professor of physiology.

The Auburn Research Foundation of the Alabama Polytechnic Institute has received a Frederick Gardner Cottrell special grant-in-aid to support the research of R. Pepinsky on the crystal structure of sugars and their derivatives. The $7,500 grant was announced by Charles H. Schauer, Research Corporation of New York City.

The Department of Chemistry, Northwestern University, has announced the promotion of Robert Burwell to the rank of associate professor, and Frederick Bordwell, I. M. Klotz, and L. Caroll King to assistant professorships. M. J. Babcock, School of Nutrition, Cornell University; Fred Basolo, Rohm and Haas, Philadelphia; Raymond P. Mariella, University of Wisconsin; Robert L. Latsinger, Massachusetts Institute of Technology; and Norten C. Melchior, University of California, have been appointed instructors.

A lectureship in memory of Arthur Stanley Eddington, astronomer and mathematician, is in process of being established. This will provide for periodic lectures, to be given in Cambridge or elsewhere and to be published, on some aspect of contemporary scientific thought considered in its bearings on the philosophy of religion or on ethics.

To establish this memorial lectureship a capital sum of about 2,500 pounds will be required. An Appeal Committee has been formed in Cambridge, England, to receive subscriptions. These may be sent to Barclay's Bank, Ltd., Cambridge, for the credit of "The Arthur Stanley Eddington Memorial Lectureship" account; to the Honorary Secretary of the Appeal Committee, W. H. Thorpe, Jesus College, Cambridge; or to the Honorary Treasurer, Howard Diamond, A. C. A., 45, St. Barnabas Road, Cambridge. Dr. Thorpe has offered to supply, to those interested, details of the administration of the lectureship, for which the Royal Society, Trinity College, and the Society of Friends have agreed to appoint trustees.

Meetings

A National Conference on Hydraulic Machinery will be held in Chicago on 22–23 October, with headquarters in the Hotel Continental. This second annual meeting is sponsored by the Graduate School and the Armour Research Foundation, Illinois Institute of Technology, with the cooperation of the Western Society of Engineers and local sections of the American Society of Civil Engineers, the American Society of Mechanical Engineers, and the Society of Automotive Engineers.

The conference chairman is V. L. Streeter, chairman of fluid mechanics and thermodynamics research, Armour Research Foundation, and correspondence relative to the general activities of the conference, with the exception of registration, should be addressed to him.

Registration has been scheduled for 9:00 A.M. on 22 October. However, persons planning to attend are urged to register in advance by mail. A check or money order for $13.50 to cover the cost of conference activities must accompany all advance registrations and should be sent to the conference secretary, O. I. Teichmann, Armour Research Foundation, Illinois Institute of Technology, 35 West 33rd Street, Chicago 16. A limited number of rooms are being reserved at the Hotel Continental for conference guests. Reservations should be made directly with the hotel as soon as possible.

The International Hematology and Rh Conference will be held in Dallas, Texas, on 15 November, in affiliation with the Second Mexican Blood Transfusion Congress, which meets in Mexico City on 17-23 November.

The morning session will be held at the Adolphus Hotel, Joseph M. Hill, director of the William Buchanan Blood, Plasma and Serum Center, Baylor University Hospital, presiding. The afternoon session will be held at the Medical Library, Baylor University Hospital, Eduardo Uribe Guerola, president of the Second Mexican Blood Transfusion Congress, presiding. Guest speakers include: Philip Levine, Ortho Research Foundation, Linden, New Jersey; R. R. Race, Lister Institute of Preventive Medicine, London; William Dameshek, Tufts Medical School, Boston; Ernest Witebsky, University of Buffalo School of Medicine; I. Davidsohn, University of Illinois College of Medicine and Mount Sinai Hospital; Louis K. Diamond, Harvard Medical School; Ludwig Hirszfeld, University of Wroclaw, Poland; Ignacio Gonzalez Guzman, University of Mexico College of Medicine, Mexico City; E. Uribe Guerola, University of Mexico College of Medicine; and J. M. Hill, Southwestern Medical College and Baylor University Hospital.

Arrangements for housing accommodations may be made by notifying Dr. Sol Haberman, William Buchanan Blood, Plasma and Serum Center, Baylor University Hospital, Dallas, Texas, before 5 November.

A symposium to explore industry's need and use of instrumentation is being planned by the New York Section of the American Institute of Chemical Engineers, to begin at 1:30 P.M. on 17 October at the Pennsylvania Hotel, New York City. The meeting will conclude with a banquet in the evening at which

E. S. Lee, of the General Electric Company, will speak on the "Philosophy of Measurements."

Papers will be presented by Ed. S. Smith, Eclipse-Pioneer Division, Bendix Aviation Corporation, on "Underlying Principles of Instrumentation and Process Control"; J. C. Peters, Leeds & Northrup Company, on "Some Design Factors Affecting Process Control"; J. A. Patterson, Publiker Industries, Inc., on "Designing a Controllable Distillation Process"; F. H. Trapnell, E. I. du Pont de Nemours & Company, on "Instrumentation and Plant Design"; and H. D. Middel, General Electric Company, on "New Developments in Instrumentation." There will also be a motion picture on modern instrumentation.

Preregistration may be made with the chairman of the symposium, G. K. Hickin, American Cyanamid Company, 30 Rockefeller Plaza, New York 20, New York. The fee for the complete program will be $6.00.

The Society for Applied Spectroscopy will hold its first program meeting of the season at 8:00 P.M., Tuesday, 1 October, at the Pennsylvania Hotel, New York City. George R. Harrison, of the Massachusetts Institute of Technology, will address the group on the present status and future trends of spectroscopy. The meetings of the Society are open to the public, and those interested in spectroscopy are invited to attend.

Elections

E. D. Merrill, Arnold professor of botany, Harvard University, has been elected an honorary fellow of the Royal Society of Edinburgh.

The Harvey Society has elected the following officers for the year 1946–47: Vincent du Vigneaud, president; Wade W. Oliver, vice-president; Colin MacLeod, treasurer; Edgar G. Miller, Jr., secretary; Earl T. Engle, Harold G. Wolff, and L. Emmett Holt, Jr., Council members.

Marston Taylor Bogert, professor emeritus of organic chemistry, Columbia University, and president of the International Union of Chemistry, has been elected to honorary membership in the Société chimique de France.

Science and the British Colonies

The time is long past when it was British policy that Colonies should have only such services as they could support from their own revenues, and the last 16 years have witnessed provision from British metropolitan funds for Colonial development and welfare which has steadily increased in quantity and in scope. The Colonial Development Act of 1929 provided 1,000,000 pounds sterling a year for economic development and research ancillary thereto. Britain's Colonial Development and Welfare Act of 1940 increased that provision to 5,000,000 pounds a year, of which up to 500,000 pounds a year might be spent on research; and the amending Act of 1945 increased the total provision to 120,000,000 pounds to be spent over 10 years, of which up to 1,000,000 pounds a year may be spent on research and investigation.

The Act of 1940–45 permits of expenditure on "welfare,"—education, public health, and other social services—as well as on economic development; but the main emphasis remains on the latter, since it is held that only on a sound and healthy economic foundation can sound social and political structures be based.

The emphasis given in the legislation to research is a clear recognition of the vital part which science must play in British Colonial development from all points of view.

Immediate large-scale action was not, however, possible. For one thing, virtually all the scientific forces of Britain were engrossed in the urgent task of defense. The flow of recruitment to scientific posts in the Colonies virtually ceased, and many of those already in the Colonies had to be diverted to work of immediate relevance to the war effort. The additional and wider experience so gained has in many cases been most valuable, but unavoidably there has been a net loss of man-years of scientific work on the basic problems of the Colonies.

In the interval before large numbers of scientists can be made available for work on Colonial problems, the Colonial Research Committee (created in 1942) has taken the opportunity to conduct a comprehensive review of the state of research and science in the Colonies. We are not tilling virgin soil; much work of the greatest value has been done in many fields, often with the direct collaboration of institutions in Britain. For example, the rubber tree of commerce, *Hevea brasiliensis,* was introduced to the Far East through the agency of the Royal Botanical Gardens at Kew, near London, and thrived better there than in its native home. The cotton industry of East Africa, notably Uganda, owes its existence to long-term scientific breeding work, as does the Kenya pyrethrum industry which, under strict scientific control, produced the highest and most uniform quality of pyrethrum in the world. During the war, because of the vital importance of pyrethrum for the manufacture of insecticidal sprays, supplies of seeds were sent from Kenya to many parts of the world (although this plant does not propagate well from seed, the normal method being the use of cuttings).

Starting in 1942, the Colonial Research Committee proceeded to review existing arrangements for research in or for the Colonies. The Committee found

that, although much good work had been and was being done, it was inadequate in quantity and not sufficiently comprehensive. In particular, the absence of comprehensive basic information in certain important fields and of machinery adequate to make good these deficiencies was noted. Accordingly, there emerged certain broad proposals which are now being carried into effect:

(1) A centralized Geodetic and Topographical Survey, designed to complete the major triangulation of the Colonies with the assistance of the Royal Air Force.

(2) A similar centralized Geological Survey, leaving specific detailed studies normally to be done, as required, by the specialist staffs of Colonial governments themselves. With (1), this will make possible for the first time a clear view of the mineral and underground water resources of the Colonies and will greatly facilitate systematic soil surveys as a basis for agricultural planning and development.

(3) A comprehensive Meteorological Service, to serve at once the needs of agriculture and those of a rapidly growing system of air communications.

(4) A much more comprehensive and systematic approach to agricultural research, involving a clear division between (a) the fundamental work best done at universities and other institutions in Britain; (b) long-term applied work in the Colonies and the various surveys in this field, to be centered on a series of regional stations, such as the existing East African Agricultural Research Institute and the Imperial College of Tropical Agriculture in Trinidad, West Indies; and (c) short-term and applied and extension work, normally best done by the Agricultural Departments of the individual Colonies.

(5) A more comprehensive organization of medical research, in association with the Medical Research Council of Britain, operating at least in part through institutes in the Colonies, of which several have existed for many years in East and West Africa, Malaya, and elsewhere.

(6) An entirely new emphasis on research in the social sciences, including anthropology, ethnography, linguistics, and socioeconomic studies, not simply on account of their intrinsic interest but also on account of their great practical value for administrations and for the contribution which they can make to the development of a sound and healthy community sense, and consequently to the whole social and political progress of Colonial peoples.

In order that work in these fields may be planned and carried out in the light of the best available advice, a series of Specialist Committees have been created. These Committees, on which scientists of the greatest eminence in their respective fields have readily agreed to serve, are carefully examining the field, scrutinizing specific proposals submitted to them, and making recommendations regarding new problems which they believe should be investigated.

Another body, the Colonial Products Research Council, came into being about the same time as the Colonial Research Committee. This serves directly the economic development of the Colonies by enlisting the full resources of science in the task of finding new and better uses for Colonial raw materials and so broadening and rendering more secure the economic basis of the life of Colonial peoples. The Council includes a number of eminent scientists in various fields and operates by selecting Colonial commodities and arranging for their systematic study in the universities or other laboratories best fitted to deal with each particular problem. By this means there is achieved a considerable economy and efficiency of effort and also a spread among scientists in Britain of knowledge of, and interest in, Colonial problems.

In choosing the commodities for study, the Council has been guided by a variety of factors, chief among which have been importance as a means of livelihood to large numbers of producers, vulnerability to economic disturbances such as the depressions between the two German wars, and promise of development. With these objectives in view, the Council chose for study: sugar and its by-products, as being the economic mainstay of many of the West Indian islands, Mauritius in the Indian Ocean, and Fiji in the Western Pacific; vegetable oils, because of their great importance for West Africa, Ceylon, and Malaya; theobromine, as a derivative of the important West African cocoa industry; eugenol, as a by-product of the clove industry of Zanzibar; sundry essential oils, as showing promise of new industries in many parts of the Colonies; and starch, which is produced in a variety of forms in many Colonial territories and could be produced readily in more if new and more varied uses are found for it. This list is far from exhaustive.

In addition, the Council has founded in Trinidad a Colonial Microbiological Research Institute. The first director of the Institute is Dr. A. C. Thaysen, who has been responsible for the evolution of a new strain of yeast (*Torulopsis utilis* var. major) and the industrial technique for its bulk manufacture on which plans have been based for a large-scale factory now nearing completion in Jamaica. This Institute, the first of its kind in the tropics, will be concerned with microbiological problems in the widest sense, including possible developments in fermentation industries based on sugar and molasses; the antibiotic action of the metabolism products of various microorganisms in relation to plant diseases such as Panama Disease (Fusarium) of bananas, which has spread havoc throughout plantations and small holdings; and the innumerable problems of decay and disease to which the very active microorganisms of tropic zones give rise. The policy of the Council is to seek, where pos-

ble, new uses and processes which may tend to de-lop industries in the Colonies themselves.

Basic surveys may be said to have three aspects or lues: (1) They clear the way for more fundamental search by indicating clearly which are the greatest eeds; (2) in themselves, they are of the utmost value r the planning and execution of schemes of develop-ment in the economic or other fields; and (3) they enable Colonial peoples to know themselves and their environments and thus take an ever-increasing part in the development of their own lands and the building up of their own communities on a basis of light and knowledge.—*C. Y. Carstairs* (Secretary, Colonial Research Committee, British Colonial Office).

In the Laboratory

An Indwelling Arterial Needle for Use n the Radial Artery[1]

. P. Henry, P. O. Greeley, V. L. Frykman, and L. Peterson, Lt. (jg), (MC) USNR

Departments of Physiology and Aviation Medicine University of Southern California, Los Angeles

The problem of obtaining arterial blood when at ltitude interposes a major difficulty in the way of nalyzing the merits of various types of high-altitude quipment. It is desirable to implant a needle in the rtery before commencing the experiment and to be ble to allow the subject a few minutes to recover rom the effects of the arterial puncture before pro-eeding. The direct tapping of an artery at altitude difficult, requiring delicacy of procedure by the perator and vasomotor stability on the part of the ubject. Both of these are not necessarily available nder conditions when there may be severe anoxia and arked discomfort.

Although satisfactory for clinical work, it was felt hat implants into the femoral artery (1) were too mmobilizing to be safe for chamber work, where rapid ovement might at any time be necessary to meet an mergency. After a number of experiments in which arious difficulties were encountered, a modified Linde-ann needle has been developed for radial implan-tion. Although still in the process of modification, has already been shown to be of practical value in ltitude studies. The following technique, modified certain respects from that used by the Columbia roup for femoral implantation (*1*) to allow for natomical differences between the two puncture sites, employed in these laboratories.

After heating the hand in water at 48° C. for five inutes to increase blood flow, the radial artery is alpated carefully while the subject rests the wrist upon a wooden block with the hand sharply extended at the wrist. The skin is sterilized, and a small amount (0.3 cc.) of 2 per cent novocain is placed on either side of the artery above the radial styloid, using a 25-gauge needle. No attempt is made to infiltrate

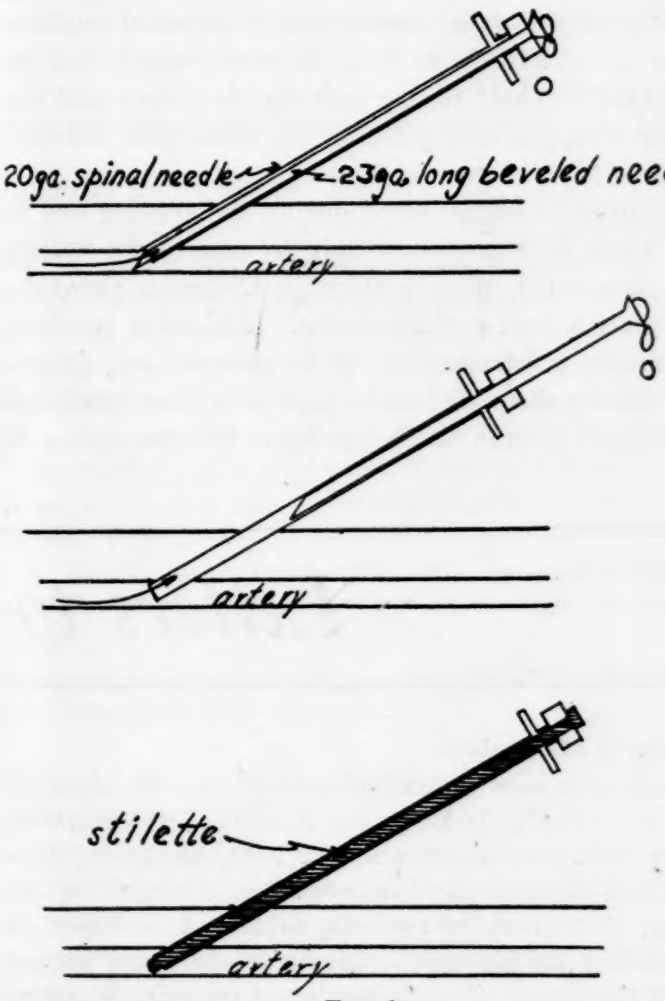

FIG. 1

the wall of the artery. If a small amount of anesthetic is used, the landmarks and the artery will not be obliterated by the mass of subcutaneous infiltration. When anesthetized, the skin is pierced directly over the artery by the implant needle. In Fig. 1 the insertion of this implant needle is presented. It consists of a 23-gauge needle honed down

[1] The work described in this paper was done under a contract, recommended by the Committee on Medical Research, between the Office of Scientific Research and Development and the University of Southern California.

to fit within a 20-gauge spinal needle. A lock is placed on the inner needle which holds it in place, making the two needles integral. The point of the inner needle and the tip of the outer needle are carefully ground to present the smoothest contour possible in an attempt to avoid any abrupt discontinuity which might render the passage of the needle point jerky. When the tip of the inner needle pierces the arterial wall, blood will flow from the butt. The needle is then advanced slightly to insure that the outer needle is also within the arterial wall. This may be verified by detaching the inner needle by operation of the lock and withdrawing slightly. If blood flows freely from the inner needle, the tip of the outer one is usually well within the lining of the vessel. The inner needle is then removed and a cone-shaped introducer slipped over the rearward projecting shaft of the outer needle. This introducer is then used to permit the easy insertion of the stilette into the outer needle. The point of the stilette is ground with the aim of converting the tip of the outer needle into a rounded surface. Once the stilette is in situ, the outer needle can be advanced one-half to one inch up the artery and the needle strapped into place on the wrist with adhesive tape.

In order to obtain blood during the ensuing one to two hours it is necessary only to remove the stilette and introducer, placing them in hydrogen peroxide, and place a Luer syringe in situ. If blood is not flowing freely, reintroduction of the peroxide-wet stilette will usually clear the needle, especially when combined with slight suction on the syringe. On completion of sampling, the introducer is replaced, and the stilette can then be slipped into place without trouble. In the absence of the introducer, considerable difficulty was experienced in inserting the stilette into the shaft of the outer needle in the face of the stream of blood issuing from it. The introducer was devised to overcome this obstacle which becomes a serious one when dexterity is poor, as during a pressure-breathing experiment at altitude.

The needles developed so far have been successfully implanted in more than 70 per cent of all attempted punctures by the three persons who have employed them. It is thought that with improved dexterity and modifications in technique the percentage of failures could be further reduced. The needle permits free use of the hand in spite of its presence at the wrist. The procedure for sampling is so simple when using the implant that blood can be obtained by the subject himself if necessary.

Although originally developed for use in high-altitude physiology, it is to be noted that this technique may be applied to the study of arterial blood pressure by the use of a suitable pressure-recording device (2). In these laboratories a "strain gauge" pressure recorder developed in collaboration with the Statham Laboratories, Los Angeles, has been used for this purpose.

References

1. Cournand, A., Riley, R. L., Breed, E. S., Baldwin, E. de F., and Richards, D. W. *J. clin. Invest.*, 1945, **24**, 106.
2. Gardner, E., and Crescitelli, F. *Science*, 1945, 102, 452.

Letters to the Editor

Origin of Microseisms

Since it is now reasonably certain from the work of Ramirez (Ph.D. Dissertation, Saint Louis University, 1939; *Bull. seismol. Soc. Amer.*, 1940, **30**, 35–84, 103–178) and Gilmore (*Bull. seismol. Soc. Amer.*, 1946, **36**, No. 2) that group microseisms, as defined by Gherzi in his various publications, originate in the ocean bottom under the center of each hurricane, typhoon, or extratropical cyclone, a satisfactory explanation is needed for the mechanics of their production.

At a conference on storms and the origin of microseisms held early last January at the U. S. Coast and Geodetic Survey in Washington and at the meeting of the American Meteorological Society in St. Louis, 29 March 1946, the writer suggested a possible mechanism which would seem to give the right order of magnitude for the quantities involved.

While quantitative data on the conditions in the interior of a hurricane are sparse and difficult to obtain we have at our disposal some fairly reliable qualitative information.

In the first place, a hurricane is an air vortex which exerts a frictional torque on the water surface. The air-water friction is considerable; in fact, the observed values of such friction seem to be greater than would be expected from simple theory. Consequently, we must expect a water vortex to be generated. A vortex motion, once generated in the water, must extend to the sea bottom, since, as is well known, a vortex in a nearly perfect fluid cannot begin or end within the fluid. It must either form a closed vortex ring or begin and end at boundaries such as the free air surface and the sea bottom in the case of the ocean. Observations seem to indicate considerable convergence and consequent piling up of the

rface water in excess of the doming to be expected om the lowered air pressure. There is no way for the cess water to escape except downward, and this piled-up water is lighter than normal.

There are three factors which affect the density of sea ter: the temperature, the pressure, and especially the linity. In the interior of a hurricane, typhoon, or tratropical cyclone, the pressure is lower and the tem- rature is higher than in the surroundings. Hence, e surface water expands, and the density is less. Fur- ermore, there is heavy precipitation, so that the salin- is lessened and the density decreased. Therefore, e piled-up lighter surface waters, escaping downward rough the core of the water vortex, penetrate into the avier water at depth. Buoyancy will come into play. e downward-plunging lighter water will be stopped d forced back upward by the surrounding heavier ter, and thus vertical oscillation of the vortex will gin. Since the vortex, as stated, must extend to the sea ttom, the vortex oscillator will deliver to the ocean bed series of blows which will set the ground vibrating d cause it to radiate elastic waves. A hurricane may ve a horizontal diameter of 200–300 miles, and an tratropical cyclone may cover a much greater area. ence, the mass of water in motion is great, and its bratory momentum will be ample to account for the served energy of the microseisms.

Let the linear vector velocity of a small portion of the ter be $\mathbf{q}$. Let ρ be the density, and let $\frac{D}{Dt}$ be the kes operator. Then the Eulerian equation of motion the water will be $\frac{D\mathbf{q}}{Dt} = \frac{\partial \mathbf{q}}{\partial t} + \mathbf{q} \cdot \nabla \mathbf{q}$, and the equation continuity, $\frac{\partial \rho}{\partial t} + \rho \operatorname{div} \mathbf{q} + \mathbf{q} \cdot \nabla \rho = 0$.

To simplify the discussion, let us assume a columnar rtex, in which the angular velocity ω is the same for parts and $\frac{D\omega}{Dt} = \omega \cdot \nabla \mathbf{q}$, and a region outside this core, which the curl vanishes, the motion depending on a locity potential ϕ, so that $\mathbf{q} = \operatorname{grad} \phi$ and $\frac{D\rho}{Dt} = \rho \nabla^2 \phi$.

Let the average density of the normal sea water in the rroundings be $\rho_0 = 1.027$, and the density of the lighter ter piled up to an average excess height h, $\rho_1 = 1.02$. t the time of motion of the lighter water down and ck be the period of oscillation of the vortex and the me as that of the microseisms, $T = 6$ seconds. Then, mbining Newton's second law of motion with the buoy- cy law, we find that $h = 2$ mm. Assuming a depth of kil. and a radius of 200 kil., the kinetic energy involved one blow on the ocean bed will be about 10^{17} ergs.

Using a formula given by Jeffreys (*Geophys. Suppl. onthly Not. R.A.S.*, 1928, **1**, 22–31), $E = 8\pi^3 \rho R \sin \Delta \frac{HV\,dt}{T^2}$, where R is the radius of the earth and ρ is its nsity, Δ is the arcual distance from the wave source to e point of observation, a is the amplitude of horizontal tion, H is 1.12 times the wave length, V is the wave velocity, and T is the wave period, we obtain for micro- seisms of 10 μ range also about 10^{17} ergs as the energy radiated in one wave.

This tentative solution is offered merely as a suggestion in the hope that it will stimulate further investigation of the problem.

JAMES B. MACELWANE, S.J.
Institute of Geophysical Technology
Saint Louis University

Verb Derived From "Fission"

The present letter was stimulated by the communication from Ira M. Freeman (*Science*, 1946, **104**, 87) in which the adjective derivable from the noun ''fission'' was discussed.

In conversations with the ''atomizers'' one often hears the verb, presumably derived from this noun. The verb, as used, is spelled ''fiss'' and pronounced similarly to ''fish.'' I maintain that if there is a verb derivable from this noun, the above verb is certainly incorrect, for it does not seem to fit into the general scheme of the derivations in English grammar. I should welcome an appropriate authoritative commentary on what seems to me an interesting variation of the language.

G. M. KOSOLAPOFF
Monsanto Chemical Company, Dayton, Ohio

Adjective Derived From "Fission"

Concerning the recent letter by Ira M. Freeman on the use of the term ''fission'' (*Science*, 1946, **104**, 87), I have found use of the word ''fissionable'' objectionable even in scientific articles. As Dr. Freeman points out, the proper word is ''fissile,'' but this is not wholly satisfactory, as it usually carries the idea of splitting into layers or plates. Might it not be wise to replace ''fissionable'' by a new word, ''fissible,'' which would be applied only to those substances capable of undergoing nuclear fission?

I would suggest that the word be pronounced as spelled. To pronounce it ''fishible'' would be unfortunate.

JOHN DAVIS BUDDHUE
Jet Propulsion Laboratory, GALCIT

Successful Use of Oxidized Cellulose in Surgery of the Uterus

During the last few years the experimental use of oxidized cellulose as an absorbable hemostatic surgical dressing has increased rapidly. The material has been used successfully in brain surgery and the abdominal cavity. Among the favorable attributes of this material are the absence of foreign-body reactions and its rapid dissolution *in vivo*.

This report is a preliminary note concerning the successful application of oxidized cellulose (kindly supplied by Johnson and Johnson) to experimental uterine surgery in the dog. Pregnant females near term were subjected to unilateral Cesarean section under pentothal or ether anesthesia. One horn of the uterus was emptied and

packed with oxidized cellulose gauze, the uterus sutured, and the incision closed. Subsequently the contents of the opposite uterine horn were emptied by normal processes, live puppies were born, and lactation became established. Ten days after the Cesarean section an exploratory operation was performed, and no gauze was found. The uterus on the packed side contained a small amount of slightly sanguineous fluid. Biopsies obtained from the operated and opposite horns revealed an indentically normal *post partum* histological appearance.

We conclude that oxidized cellulose may safely be used as a hemostatic uterine surgical packing.

HARLEY E. ANDERSON and A. R. MCINTYRE
The University of Nebraska Medical School, Omaha

Trophoblast Elements in Cancer

In confirmation of the findings of Roffo (*Bol. Inst. med. exp. Estud. Cancer*, 1944, **21**, 419–588) that, when injected into immature white rats, an extract of the blood or urine of cancer patients causes enlargement of the uterus and the formation of corpora lutea in the female animals, we have obtained from cancer patients of both sexes, by urinary extraction, preparations having pronounced estrogenic as well as gonadotropic properties. Nonmalignant, nonpregnant controls were negative.

It is our conclusion, on the basis of studies now in progress (*Science*, 1946, **103**, 25), that the estrogenic factor (termed "steroid E" by Roffo) arising from the definitive malignant elements is identical with the steroids produced by the syncytial trophoblast of pregnancy (Jones, Gey, and Gey. *Johns Hopk. Hosp. Bull.*, 1943, 72, 23–38). The only so-called false positives observed by Roffo were those in which pregnancy urine was used. Moreover, 20 days after implanting human trophoblast into the eye of a virgin doe, we found uterine and ovarian changes which duplicated those reported above for the immature rat recipients of cancer urine (*J. clin. Endocrinol.*, in press).

It is well known that chorionepitheliomas, genital as well as primary extragenital in both sexes; many ovarian and most testicular cancers; the chorionic (trophoblastic) or malignant phase of many teratomata; and even some cases of carcinoma simplex are responsible for the presence of chorionic (cytotrophoblastic) prolan in sufficient quantities in the blood or urine to produce a positive Aschheim-Zondek reaction. In these tumors the prolan titer tends to vary directly with the concentration of cytotrophoblast (Langhans cells), being almost beyond detection in the absence of overt trophoblast.

Using rodents as indicators, it is impossible to distinguish accurately between anterior pituitary and chorionic prolans. In pregnancy and in the malignant tumors cited, the chorionic prolan is present in such excess of pituitary prolan that diagnosis becomes a matter of quantitation. In the past, attempts to recover chorionic prolan from the blood or urine of all cancer cases showing no *overt* trophoblast have been thwarted by cross-reactions with pituitary prolan. Employing the technics of chromatographic adsorption (Katzman, Godfrid, Kain, and Doisy. *J. biol. Chem.*, 1943, **148**, 501–507) and the use of the African clawed toad (*Xenopus laevis*) as a specific indicator of chorionic prolan, these obstacles are overcome. Employing a combination of such technics, we have obtained ex extrusion in *Xenopus laevis* through the injection of 1 c of the concentrate of as little as 800 cc. of urine fro nongenital cancer in the human male. Controls of th same age were negative.

Although sufficient determinations have not yet bee made to warrant the conclusion that specific steroid and/or cytotrophoblastic prolans are present in all cas of cancer, our preliminary results would suggest this.

In conclusion, it would appear significant that ma of the most malignant exhibitions of cancer are know to yield a readily detectable quantity of gonadotropi duplicated only by that produced by the trophoblast cel that now tumors of lesser malignancy are found to yie this same gonadotropin; and, finally, that the only ex never observed in the benign state in the male or, asi from the canalization of pregnancy, in the female is th trophoblast cell. Parallel to this is the finding in canc of a steroid duplicated only by the syncytial trophobla These data would seem further to substantiate the un tarian nature of all exhibitions of cancer and to sugge the trophoblast elements (however masked morpholog cally) as the constant malignant component.

ERNST T. KREBS, J
University of California Medical School, San Francisco
CHARLES GURCH
San Francisco, California

Japanese Scientists and the POW's

I read with interest the article on "The war a biological sciences in Japan" (*Science*, 1946, 103, 75 758). Lt. Gressitt states that it is his belief that t majority of the Japanese were ignorant of the actu facts of the war and resentful of the militarists. L me present the picture from a different point of vie I was there during the war as a prisoner, having be captured on Bataan and taken to Japan in Novemb 1942. From that time until the end of the war I w in three camps scattered from Shikoku Island on t south, to Osaka in the central portion, to the foothi of the alps near Fukui.

Of all the classes of Japanese people that we pris ers encountered, the scientists, and especially the ph sicians, were the most haughty, resentful, hateful, a cruel. Physical conditions of the prisoners meant not ing to the Japanese doctors. The Japanese Army Me cal Corps fought a good war on the Prisoner Fro succeeding as they did, in killing off many allied pris ers. Presentation of scientific evidence of malnutriti in addition to loss of weight, was laughed at. Men wi 101° fever were sent out to backbreaking labor, as we those unfortunates quaking with malarial chill.

Construction by the writer of a handmade biophoto eter to run some eye tests and subsequent discove of this by the Japanese doctor at the camp resulted n in scientific curiosity but only in a good beating. Fro camp to camp the same was true. The better-educat Japanese, although they would not admit it, realiz

that their war effort was futile and that Japan was doomed. As a result, all of us were hated and treated poorly. Those who had been educated in the United States realized our love for books or relaxation in a game of bridge and tried all the more to deny these to us. At a hospital in Osaka, near Umeda Railroad Station, where we were occasionally taken for treatment about one and one-half years before the B-29's began raiding Japan, the civilian doctors, biochemists, and bacteriologists on the staff laughed at us, sneered, and only reluctantly gave very poor treatment. Their optometrist, with facilities available, for spite refused to correct for astigmatism in prescriptions for glasses. Thus it went on in this and other hospitals throughout Japan.

This is the picture of Japanese intellectuals taken from inside Japan. Of course, when the end of the war came, they did a complete about-face. This is undoubtedly what Lt. Gressitt found when he went to Japan.

SAMUEL A. GOLDBLITH
Nutritional Biochemistry Laboratories
Massachusetts Institute of Technology

Two Kinds of Neutrons?

The present concept of the structure of the neutron is generally given as a negative electron in close association with a proton. Among many others, Harkins (*Science*, 1946, 103, 298) has indicated that the neutron is converted into a proton with the emission of a β-particle,

$$n^1_0 \rightarrow p_{+1}{}^1 + e_{-1}{}^0$$

causing an increase of one unit in the atomic number of the nucleus of the atom in which this process takes place. The neutron has been predicted by Wang (*Nature, Lond.*, 1945, 155, 574) to be β-radioactive, with a half-life of about three hours.

With increasing emphasis on the existence of the negative proton, especially in connection with cosmic ray studies, theory apparently requires a second kind of neutron. Employing the designation An^1_0 for the usual neutron, the second kind can be distinguished as follows:

$$Bn^1_0 \rightarrow p_{-1}{}^1 + e_{+1}{}^0.$$

The new neutron would be comprised of a positive electron or positron in association with a negative proton and would likewise be radioactive, assuming the validity of Wang's study.

The possible existence of a second kind of neutron, having the same mass and lack of charge as the usual variety, gives rise to a number of interesting concepts for nuclear physics. For example, Harkins (*ibid.*) states that a positron is given off when a proton changes into a neutron (An^1_0):

$$p_{+1}{}^1 \rightarrow An^1_0 + e_{+1}{}^0.$$

Or, interpreted in terms of the Bn^1_0,

$$p_{-1}{}^1 \rightarrow Bn^1_0 + e_{-1}{}^0,$$

this would mean that a negative proton may change into a Bn^1_0 when a negative electron is released. Other interesting features of this concept will be evident to those in the field.

JACK DE MENT
Fluorescence Laboratories, Portland, Oregon

Quantification of Micronutrients

Quantities of vitamins in rations have been reported in a variety of ways, such as International Units, micrograms per gram, milligrams per 100 grams, or milligrams per cent.

Some of the authors who use metric units in their reports in biological journals are also writing for trade journals and reporting the vitamin contents of the rations in milligrams per pound—a mixture of the metric and the English system of weights and, in our opinion, a very unhandy system. In the same trade journals the quantities of trace minerals in rations are frequently reported in "parts per million" (ppm). An article in one journal reports some of the ingredients of a ration in per cent of ration, other ingredients in parts per million, and still others in milligrams per pound.

Would it not be much simpler if the micronutrients (vitamins and trace minerals) were reported in the scientific journals in micrograms per gram? These data could be translated directly into trade journals as "parts per million," because the number of micrograms per gram is also the number of parts per million. The advantage of doing this in the trade journals (such as *Feedstuffs*) is that both the minerals and the vitamins would be reported in the same units (ppm), and the reference in the technical journals, reporting in micrograms per gram, would require no recalculations.

HAROLD N. SIMPSON
Harold N. Simpson Company, Oak Park, Illinois

Complement Fixation in Rats' Blood Sera

The purpose of this letter is to report that we have found that blood sera from rats captured at Nuevo Laredo, Mexico, fixed the complement only with Rickettsia antigens from classic typhus.

The titers of these sera were up to 1:40, and weak crossed fixation appeared in two of them at 1:10—with Rickettsia antigens of murine typhus. H. Plotz has informed us that he has recently obtained the same data with sera of rats from Manila.

The results of our examinations of blood sera from rats captured in Nuevo Laredo were: positive murines, 49 per cent; positive classics, 5 per cent.

Complement fixation with classic antigen in rats' blood sera leads us to believe in natural infection of these rodents with this variety of typhus.

GERARDO VARELA, CARLOS ORTIZ MARIOTTE, and ROBERTO SILVA
Instituto de Salubridad Enfermedades Tropicales and *Dirección General de Epidemiología, Mexico, D. F.*

A Relativistic Misconception

It is evident, from many recent writings on the atomic bomb, that a serious misconception still persists, not only in the popular press but also in the minds of some scientists. The idea that matter and energy are interconvertible is due to a misunderstanding of Einstein's equation, $E = mc^2$. This equation does not state that a mass, *m*,

can be converted into an energy, E, but that an object of mass m contains simultaneously an energy, E.

In nuclear reactions there is never any actual change in the total mass content of the universe. For example, the fission of a nucleus of mass M into two equal fragments, each of rest mass m_0, sets free an energy of

$$E = (M - 2m_0)c^2 \quad (1)$$

which gives a velocity, v, to each fission fragment. The kinetic energy of each fragment at this velocity is given by the Lorentz equations as

$$\tfrac{1}{2}E = m_0c^2\left(\frac{1}{\sqrt{1 - v^2/c^2}} - 1\right). \quad (2)$$

Now the mass of a particle at velocity v is

$$m = \frac{m_0}{\sqrt{1 - v^2/c^2}}. \quad (3)$$

Therefore, equation (2) becomes

$$\tfrac{1}{2}E = mc^2 - m_0c^2. \quad (4)$$

Combining equations (1) and (4) gives:

$$(M - 2m_0)c^2 = 2mc^2 - 2m_0c^2, \quad (5)$$

from which, by cancellation of terms,

$$M = 2m. \quad (6)$$

The final total mass is thus exactly equal to the initial mass. The system does not lose any mass until collisions with other particles gradually remove kinetic energy and mass from the fission fragments, and then the mass gained by the other particles is exactly equal to the mass lost by the fission fragments. Mass is not detroyed but merely dispersed, just as the potential energy originally contained in the fissionable nucleus is dispersed as kinetic energy of the particles struck by the fission fragments.

In the preceding derivation, M is the mass of the fissionable nucleus plus the neutron added to trigger it off. Also, it was assumed that M is essentially at rest, that two exactly equal fission fragments are produced, and that no extra neutrons are released. If it is assumed that both the fissionable nucleus and its triggering neutron are originally in motion, that unequal fission fragments are produced, and that several neutrons are liberated at high velocities, the equations are more involved, but the same result is obtained, namely, that the sum of all masses before the reaction is exactly equal to the sum of all masses after the reaction. In calculating the kinetic energy released or consumed by nuclear reactions from the formula, $E = (\Delta m)c^2$, the rest masses and not the actual masses must be used in computing Δm.

Likewise, in the "annihilation" of a positron and electron, it can be shown (remembering that the mass of a photon is $h\nu/c^2$) that the total mass of the photon or photons produced is exactly equal to the combined mass of the electron and positron "annihilated."

The law of conservation of mass still holds.

C. ROLAND EDDY

305 Meehan Street, Philadelphia 19, Pennsylvania

Book Reviews

Scientific, medical and technical books published in the United States of America, 1930–1944: a selected list of titles in print with annotations. R. R. Hawkins. (Ed.) (Prepared under the direction of the National Research Council's Committee on Bibliography of American Scientific and Technical Books.) Washington, D. C.: 1946. Pp. xv + 1114. $20.00. (Distributed by R. R. Bowker Co., 62 West 45th Street, New York City 19.)

In 1943 the American publisher's mission to South America brought to the attention of the State Department the need for a comprehensive selected bibliography of recent American publications in science, medicine, and technology. In 1944 the National Research Council appointed a committe to direct the project and R. R. Hawkins, chief of the Science and Technology Room, New York Public Library, was chosen as editor. This book is the result of the committee's work.

The bibliography is designed as a list not of best books but rather of important and useful books, with primary emphasis on availability. Titles of 5,193 books published between 1930 and January 1945 by citizens of the United States and Canada and still in print at the time of publication of the list are included. Thus, this bibliography will be of value not only to librarians and scholars abroad, especially those in war-devastated areas charged with the task of reconstructing libraries, but also to those in this country who may wish reliable and accurate information on American scientific, medical, and technical books of the past 15 years.

The titles are classified in broad categories with appropriate subdivisions. Thus, the first section is headed "Science" and carries the following subheads: general, dictionaries, history, methodology, popular works, textbooks, tables, annuals, and scientific expeditions. Mathematics, astronomy, physics, meteorology, chemistry, geology, oceanography, natural history, biology, botany, zoology, etc. are similarly classified, in many cases with more detailed subheads. The price of each item is included together with the table of contents and a descriptive note. These notes are especially useful, since they indicate the character of the book, give special information about its contents not obvious from the title, and suggest the type of reader for whom the book is intended. An appendix provides a directory of state agencies in the United States issuing publications in geology, engineering, and agriculture. There is also a useful directory of publishers. Finally, there is an author index, with certain title entries included, and a detailed subject index.

The social sciences in general have been omitted, as were also trade publications and elementary and high

school texts. In some instances important works otherwise qualified were left out because they were temporarily out of print due to wartime paper shortages. Despite these omissions, some of which were unavoidable, this bulky volume stands as an impressive record of American scholarship in the fields represented.

MORRIS C. LEIKIND
Library of Congress, Washington, D. C.

An introduction to the study of eclipsing variables. **Zdenek Kopal. Cambridge, Mass.: Harvard Univ. Press, 1946. Pp. x + 220. $4.00.**

The title of this book (No. 6 of the Harvard Observatory Monographs) reads like that of an elementary textbook, but it is neither a text nor elementary. It is a scholarly treatise and an introduction to the interpretation of the light variations of eclipsing stars, evidently written for the investigator who expects to devote an appreciable fraction of his career to research on eclipsing binaries.

The book opens appropriately with a brief foreword by Prof. Henry Norris Russell, of Princeton, who developed the first general method of computing orbital elements of these stars. The first chapter gives a brief history of the subject and delimits the field of the book. It is here that the reader finds that the book does not purport to tell "all about" eclipsing variables, for all aspects of the subject other than the light curve and its interpretation are outside its scope.

The second chapter, "Nature of the Eclipses," treats the geometrical relations that determine the light curve and includes a discussion of the theory of darkening at the limbs of stellar disks. The third chapter, "Determination of the Elements," considers the reverse problem: given the light curve, to find the geometrical elements of the system. In this earlier portion of the book the mainstay is the original Russell method and others of similar nature which are still the most practical way of beginning the computation. The fourth chapter, "Improvement of Preliminary Elements and Determination of Limb-Darkening," completes the discussion of the simpler problem of spherical stars moving in circular orbits.

The next chapter discusses the complications that arise from eccentricity of orbits. This is followed by a chapter on the theory of tidal distortion of stars and that of "gravity-darkening" or nonuniformity of surface brightness of distorted stars. The effects upon the light curve of ellipticity of the stars and of reflection or absorption and reradiation of the light of each body by the other form the subject of the seventh chapter. The eighth and ninth chapters embody all these complications and correspond, respectively, to the two aspects of the simpler case covered in the second and third chapters. In this latter part of the book the treatment leans heavily upon the important original contributions by the author himself.

The book is well organized and well written. The treatment throughout is strictly mathematical, but with adequate descriptive paragraphs. If it has a defect, it is in the lack of diagrams (only one is given). The practical computer may be disappointed at finding no illustrations of processes. On the other hand, there are numerous suggestions that the computer will find invaluable, for, in spite of recent progress, the solution of every individual orbit is a unique problem and in the last analysis must depend upon trial and error.

The reviewer was a little disappointed to find the scope of the book deliberately limited. A chapter or appendix of less than 20 pages could have covered in outline the contributions of spectroscopy in determining absolute dimensions and the extent of atmospheres. The special problem of stars with diffuse limbs is likewise omitted.

This is the only comprehensive treatment of the subject in any language. It will undoubtedly prove to be a stimulus to further research in the field, which is in a state of rapid flux. It should be in the library not only of every student of binary stars but of everyone interested in the astronomical applications of mathematics.

DEAN B. MCLAUGHLIN
The Observatory, University of Michigan

A future for preventive medicine. **Edward J. Stieglitz. New York: Commonwealth Fund, 1945. Pp. xviii + 77. $1.00.**

This monograph is one in a series issued under the auspices of the Committee on Medicine and the Changing Order of the New York Academy of Medicine and published by the Commonwealth Fund.

Dr. Stieglitz interprets preventive medicine as meaning more than the prevention of disease. It is rather the attainment of optimum health and well-being by the individual. With this viewpoint most of the teachers in the field of preventive medicine and many of the advanced men in medicine will agree. The author argues that the full achievement of preventive medicine requires the cooperation of the physician, the collective public, and the individual. On pages 16–18 we are given the change in the age structure of the population that has come about in the United States over the last eight decades. This change in grouping makes all the more important this emphasis on the individual preventive medicine rather than the preventive medicine of the past, which had largely to do with the prevention of communicable diseases. He rightly calls attention to the fact that, up to the present, individualized health guidance has been developed entirely in the fields of pediatrics and obstetrics. The health problems of middle and old age must come to the fore if the public is to have maximum health, usefulness, and happiness. It is not so much longer living as it is a better and fuller living.

Dr. Stieglitz holds out for a very detailed examination which will mount up considerably in cost and be beyond the reach of many that should have this type of health service. While the reviewer agrees with this idea, it must not be forgotten that there are a few essential laboratory tests, together with a rather complete but in-

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expensive physical examination, that will show beginning deviations from the normal. More detailed tests can be given where indicated by this examination.

In the field of individual health and medical guidance, this monograph represents advanced thinking and is an excellent contribution to the subject of preventive medicine.

FRED J. WAMPLER

The American Rolling Mill Company
Baltimore, Maryland

L'action des toxiques sur la cellule en division. **Paul Sentein. Montpellier, France: Causse, Graille, Castelnau, 1941. Pp. 253. (Illustrated.)**

This work comes from the Laboratoire d'Histologie de la Faculté de Médecine and the Centre Anti-Cancéreux de Montpellier. The review chapters are devoted to a chronology of the mitotic poisons of the sort many of us have wished was available. This begins by tracing the early work in Dustin's laboratory and its relation to antecedent and concurrent researches. The effects of proteins, peptones, and acids opened this history-making phase of research in mitosis. Then followed the discovery of early mitotic poisons: trypan blue, trypaflavine, and the arsenicals. Colchicine, although not the first *poison caryoclasique,* by its efficacy made possible whole new fields of research. Here Sentein outlines first the chronological course of discovery. He examines and rejects the early arguments for stimulation of mitosis by colchicine. The third section of the chapter is a compendium of information on variation in colchicine solutions when aged or exposed to light, and on variation in effects as solvent, organism, and site of administration are changed. Colchiceine is listed as more active than colchicine, in contrast to the opinions of most authors. Here and in subsequent chapters the historical approach is subordinated to arrangement by subject matter in a way that permits ready reference. The reader often wishes for a more complete literature list, however, as he finds references to work not listed in the bibliography. The third chapter reviews, briefly, other mitotic poisons: dyes, arsenicals, oils, narcotics, metaloids and metals, toxins and venoms, the aromatic hydrocarbons, and the sulfonamides. Uses for the colchicine technique in attacking biological problems take up the fourth chapter, which includes mostly studies of regeneration and hyperplasia, particularly under the influence of hormones. Next is outlined the history of cancer therapy in plants and animals by means of mitotic poisons. The sixth chapter is devoted to the author's own experiments. Effects of colchicine or chloral hydrate on mitosis in tissues of eggs, larvae, and adults of several amphibia provide a part of the fundamental approach which the author emphasizes as needful in the study of cancer. Colchicine blocked mitosis in human epitheliomata, and subsequent X-radiation eradicated the growths.

IVOR CORNMAN

Sloan-Kettering Institute, New York City

Scientific Book Register

CROMWELL, GERTRUDE E. *The health of the school child.* Philadelphia-London: W. B. Saunders, 1946. Pp. xi + 256. (Illustrated.) $2.50.

FURON, RAYMOND. *Formulaire technique du préhistorien.* Paris: Paul Lechevalier, 1945. Pp. 118. (Illustrated.) 55 fr.

GREAVES, JOSEPH E., and GREAVES, ETHELYN O. *Elementary bacteriology.* (5th ed.) Philadelphia-London: W. B. Saunders, 1946. Pp. xvii + 613. $4.00.

GROSS, MARTIN. *Acetanilid: a critical bibliographic review.* New Haven: Millhouse Press, 1946. Pp. 155. $3.00.

GUTHRIE, DOUGLAS. *A history of medicine.* Philadelphia-London-Montreal: J. B. Lippincott, 1946. Pp. xvi + 448. (Illustrated.) $6.00.

HARROW, BENJAMIN. *Textbook of biochemistry.* (4th ed.) Philadelphia-London: W. B. Saunders, 1946. Pp. xiii + 591. (Illustrated.) $4.25.

HILDEBRAND, SAMUEL F. *A descriptive catalog of the shore of Peru.* (Smithsonian Institution, U. S. National Museum Bull. 189.) Washington, D. C.: Government Printing Office, 1946. Pp. xi + 530. $1.25.

MASON, ROBERT L., and ZINTEL, HAROLD A. (Eds.) *Preoperative and postoperative treatment.* (2nd ed.) Philadelphia-London: W. B. Saunders, 1946. Pp. xiv + 584. (Illustrated.) $7.00.

MILLARD, NELLIE D., and SHOWERS, MARY JANE C. *Laboratory manual of anatomy and physiology.* Philadelphia-London: W. B. Saunders, 1946. Pp. viii + 119. (Illustrated.) $1.00.

MORSE, MARY ELIZABETH, and FROBISHER, MARTIN. *Microbiology for nurses.* (7th ed.) Philadelphia-London: W. B. Saunders, 1946. Pp. xii + 521. (Illustrated.) $3.00.

MUENSCHER, W. C. *Keys to woody plants.* (5th ed.) Ithaca, N. Y.: Comstock, 1946. Pp. 108. (Illustrated.) $1.25.

PATTEN, BRADLEY M. *Human embryology.* Philadelphia-Toronto: Blakiston, 1946. Pp. xv + 776. (Illustrated.) $7.00.

PRICE, WILLIAM E., and BRUCE, GEORGE H. *Chemistry and human affairs.* Yonkers-on-Hudson, N. Y.: World Book Co., 1946. Pp. xii + 788. (Illustrated.) $2.68.

SOKOLNIKOFF, I. S. *Mathematical theory of elasticity.* New York: McGraw-Hill, 1946. Pp. ix + 367. (Illustrated.) $4.50.

URBACH, ERICH. *Skin diseases, nutrition and metabolism.* New York: Grune and Stratton, 1946. Pp. xxii + 634. (Illustrated.) $10.00.

WARD, A. G. *Colloids, their properties and applications.* New York: Interscience Publishers, 1946. Pp. 133. (Illustrated.) $1.75.

YATES, RAYMOND F. *The working electron: an introduction to electronics.* New York-London: Harper, 1946. Pp. 247. (Illustrated.) $2.50.